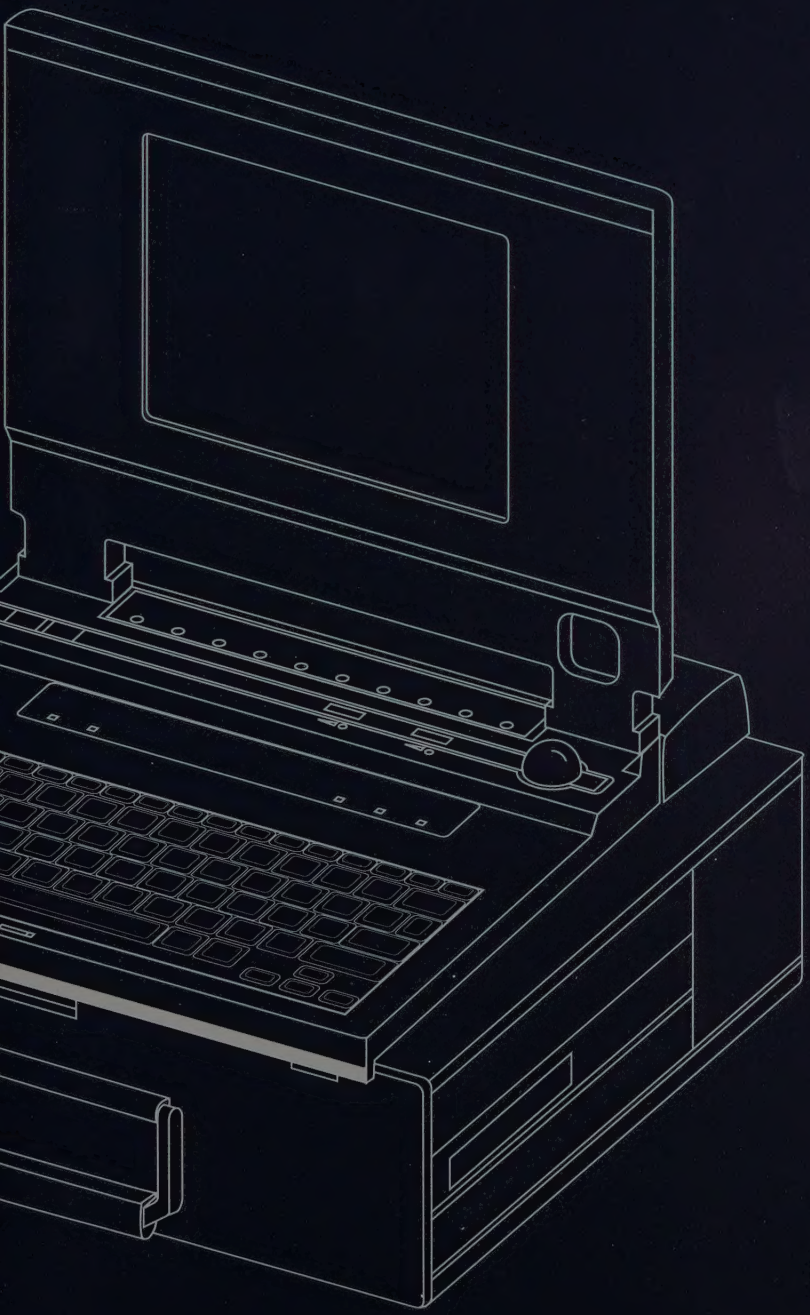
FIREBERD® 300/500



T1/Data Test Module User's Guide

TTC™
A Dynatech Company

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FIREBERD 300/500

T1/DATA TEST MODULE

USER'S GUIDE

DECEMBER 1994

Rev. A

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20400 Observation Drive, Germantown, Maryland 20876
(800) 638-2049 • (301) 353-1550 • FAX (301) 353-9216
WWW Address: http://www.ttc.com

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PREFACE

This user's guide describes the operation of the T1/Data test module option. It is written for those who are already familiar with the FIREBERD 500 Internetwork Analyzer operation. If you are unfamiliar with the FIREBERD 500 mainframe operating convention, please read the *FIREBERD 500 Internetwork Analyzer User's Guide* before proceeding.

You will notice that window selections and menu item choices are indicated by **bold type** text. You will also notice that words in **bold type** often have a letter underlined on the window (e.g., **File**). The underlined letter on the window indicates the key on the keyboard you press, along with the **Alt** or **Ctrl** key, to select the associated menu or menu item.

For example, with the T1/Data configuration window displayed, simultaneously pressing the **Alt** and **M** keys causes the Test Manager menu to be redisplayed. This two-key combination is an alternative way to select menus and menu items without using the trackball and the trackball selection button.

Depending on the configuration of your FIREBERD 500 Internetwork Analyzer, you may not be able to access all of the screens described in this manual. If the required option is not installed, the selections are not displayed. If a selection is displayed but is grayed out, that selection is not available for the current operating configuration.

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SECTION 1
GETTING STARTED

1.1 SECTION OVERVIEW

This section basically describes what you need to know to begin testing with the T1/Data Test Module. Information in this section includes:

- T1/Data Test Module overview
- T1/Data application selection
- T1/Data configuration window
- Testing
- Logging
- Menu choices

1.2 T1/DATA TEST MODULE OVERVIEW

Depending on the FIREBERD 300/500 mainframe configuration, you may be able to perform one or more types of Physical Layer testing. The FIREBERD 300/500 mainframe configuration and the options installed determine the windows that are displayed and the choices available on the windows. Table 1-1 lists the FIREBERD mainframes configuration, options, and capabilities.

Table 1-1
FIREBERD 300/500 Mainframe Configurations

FIREBERD 300	Option	Capability
FB320	T1/Data Interface Test Module	Monitor Only. Provides the physical interface to full-duplex T1, V.35, RS-449, and RS-232-C circuits. Includes 5 MHz synthesizer and V.35, RS-449, and RS-232 cables.
FB323	Data Interface Module	Monitor Only. Provides physical interface to full-duplex V.35, RS-449, and RS-232-C circuits. Includes 5 MHz synthesizer and V.35, RS-449, and RS-232 cables.
FB300-1	BERT Option	Provides Bit Error Rate Testing capability for T1, Fractional T1, DDS, and Data circuits. Requires FB320 or FB323 to be installed.
FIREBERD 500		
FB520	T1/Data Interface Test Module	Provides the physical interface to full-duplex T1, V.35, RS-449, and RS-232-C circuits. Including BERT capabilities for T1, Fractional T1, SW56, DDS, and Data circuits. Includes 5 MHz synthesizer and V.35, RS-449, and RS-232 cables.

The T1/Data Test Module, installed in the FIREBERD 300/500 mainframe, enables you to monitor a circuit or to perform Physical Layer (Layer 1 of the OSI Reference Model) testing by performing a bit error rate test (BERT). The T1/Data Test Module also provides the Physical Layer interface when you are testing WAN protocol.

Testing with the T1/Data interface takes one of two forms. Testing is either considered to be non-intrusive or intrusive. Non-intrusive testing allows you to observe (monitor) data on a circuit without interrupting it. Intrusive testing allows you to insert data, from a single bit up to the whole data stream, into the circuit under test.

The following list indicates the types of tests that you can perform with the T1/Data Test Module installed in the FIREBERD 300/500.

Testing:	Equipment Tested:
Synchronous	Synchronous modems and data channels, all basic data applications, channel cards, etc.
T1	T1 links, multiplexers, cross-connect systems, channel service units (CSUs), channel banks, and repeaters.

1.3 T1/DATA APPLICATION SELECTION

With the Test Manager window displayed, as shown in Figure 1-1, click on the T1/Data icon to open the T1/Data application.

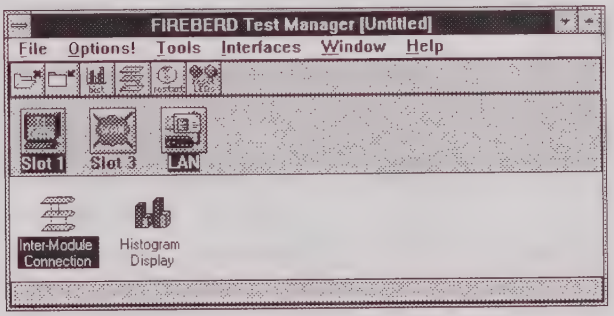

Figure 1-1
FIREBERD Test Manager Window

1.4 T1/DATA CONFIGURATION WINDOW

To load the T1/Data application and display the default T1/Data configuration window, as shown in Figure 1-2, click on the T1/Data icon on the Test Manager window. The windows displayed and the choices available are determined by the FIREBERD 300/500 mainframe configuration. If you have the WAN option installed, the default window is the Data Configuration window.

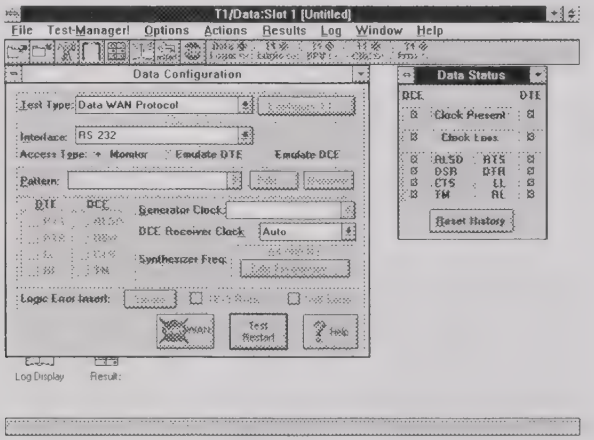

Figure 1-2
Example of a Default T1/Data Configuration Window

1.4.1 Common Activities

Regardless of the testing to be performed, certain steps are repeatedly performed. These basic steps are:

1. Select the Test Type (this determines the displayed configuration window).
2. Configure the displayed window for the test you want to perform.
3. Configure the Results and Log windows to display and log the results of interest to you.
4. Connect to the circuit you are to monitor or test.
5. Click on Test Restart to clear results values and begin accumulating results.

6. Observe accumulating results values and the results LEDs status for the circuit being tested.

7. Run the WAN application (if installed).

NOTE: The results values accumulate continuously, regardless of whether you have selected them or not. This allows you to select a result after you have started a test and see the accumulated results value from the time the test was started.

1.4.2 T1 - Top Level Configuration

When T1 BERT is selected as the **Test Type**, the T1 Configuration - Top Level window, as shown in Figure 1-3, is displayed.

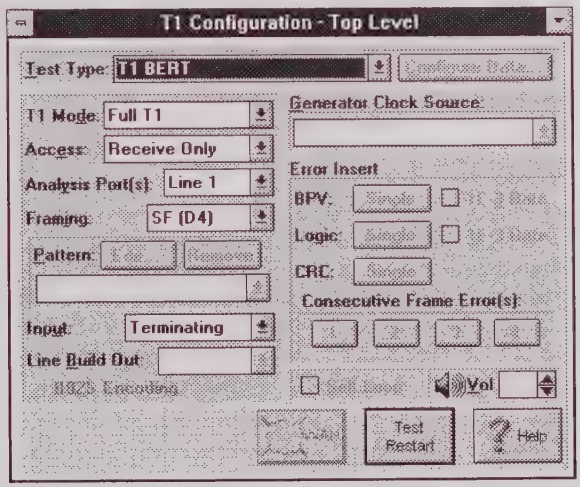

Figure 1-3
T1 Configuration - Top Level Window

If the Access choice is set to Originate or Drop & Insert, a dialog box is displayed stating that you are about to perform an intrusive test, as shown in Figure 1-4.

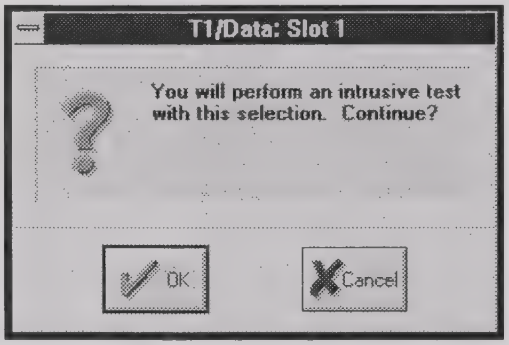

Figure 1-4
Intrusive Dialog Box

If you don't want to perform an intrusive test, clicking on **Cancel**, in the displayed dialog box, closes the dialog box and redisplays the T1 Configuration - Top Level configuration window without making the Access change. However, if you want to perform an intrusive test, click on **OK**. Clicking on **OK** closes the dialog box and redisplays the T1 Configuration - Top Level window with the Access change you made to perform the intrusive testing.

With the T1 Configuration -Top Level window displayed, observe the menu items and verify the displayed choices are correct for the test to be performed. The following is a brief description of the function of each menu item selection.

Test Type	Determines the type of test you want to perform.
T1 Mode	Identifies the portion of the T1 data to be tested.
Access	Identifies the type of access performed on the circuit.
Analysis Port(s)	Identifies which line is being used for the selected test.
Framing	Identifies the type of framing within the T1 signal.
Pattern	Indicates the transmitted data sequence.
Input	Identifies the type of input access.
Line Build Out	Indicates the amount of signal attenuation.

B8ZS Encoding	Indicates if B8ZS encoding is being used for the transmitted signal or not.
Generator Clock Source	Indicates the source of timing for the generator clock.
Error Insert	Allows you to insert either a single error or an error rate into the data stream.
BPV	Inserts a bipolar violation into the data stream.
Logic	Inserts a bit error into the data stream.
CRC	Inserts a CRC error in the data stream.
Consecutive Frame Error(s)	Inserts 1 to 4 consecutive frame errors in the data stream.
Self Loop	Indicates that the output is electronically looped back to the input.
Vol	Indicates the audio level for SW56 T1 Mode selections.
Test Restart	Clears all accumulated results values and resumes accumulating values again.
Help	Provides on-line help for this window.

The T1 Status box indicates the current state of the status LEDs for the T1 circuit being tested. The LED status is grayed out if the status is not available for the current test configuration. The color of the status LED indicates the current or past condition of the associated function. Click on **Reset History** to determine whether the status is current or past history.

The T1 Status LEDs are:

Pattern Sync	Green when synchronization is achieved with the received data pattern.
Frame Sync	Green when synchronization is achieved with the selected framing pattern.
Signal	Green when signal presence (e.g., signal transitions) is detected at the receiver.
Pattern Loss*	Red when the pattern received is not what is expected, or when 250 bit errors are detected in 1000 bits.
Frame Loss*	Red when 2 consecutive frame bits are received in error.

Signal Loss*	Red when no longer receiving signal transitions.
Pattern Slip*	Red when a portion of the received pseudorandom pattern is lost or has bits inserted into it.
B8ZS	Yellow when the B8ZS violation sequence has been detected.
RAI (Yellow)	Red when bit 2 in every channel is set to 0 for 1 second (for D4); or received a yellow alarm message in the Data Link (for ESF).
AIS	Red when 2 consecutive frames have been received with less than 3 zeros in the data while out of frame synchronization.
No Gen Clock	Red when no signal transitions are detected at the selected generator clock source.

* Indicates a history status LED that illuminates when the associated event occurred in the past or is currently present. Clicking on **Reset History** clears the illuminated history LED if the event is no longer current.

1.4.2 Results Status LEDs

The LEDs on the Display Keyboard Assembly (DKA) correspond to the Status LEDs as follows:

- When the Status LED illuminates, the corresponding RESULTS STATUS LED on the DKA illuminates.
- When no interface is active, both the red and green RESULTS STATUS LEDs are extinguished.
- When all valid summary results are ready and have a value of 0, the green LED is illuminated.
- When the green LED is illuminated, the red LED is extinguished.
- When at least one valid result is ready and does not have a value of 0, the green LED is extinguished and the red LED is illuminated.

A valid result is one that is appropriate for the test being performed. For example, if you select SF (D4) framing, then CRC errors is not a valid result.

A non-zero summary result is a summary result that is ready and is no longer zero.

The following list indicates the summary results for T1:

Bit errors
Pattern slips
BPVs
Frame errors
CRC errors
Far CRCs
Far severely errored frame seconds
Far frame errored seconds
Far BPV seconds
Far slip seconds

1.4.3 Data Configuration

If you have selected a Data Test Type, then a Data Configuration window is displayed as shown in Figure 1-5. The choices available on this window are as follows:

Test Type — Determines the type of test you want to perform.

Interface — Identifies the type of data interface to be tested.

Access Type — Identifies the type of access performed on the circuit.

Pattern — Indicates the data sequence that is transmitted.

DTE — Identifies the transmit lead status when emulating DTE.

DCE — Identifies the transmit lead status when emulating DCE.

Generator Clock — Indicates the source of timing for the generator clock.

DCE Receiver Clock — Indicates the receiver clock source when emulating a DCE.

Synthesizer Freq — Indicates the internal synthesizer frequency when Generator Clock is set to Internal (Synthesizer).

Logic Error Insert Allows you to insert either a single logic error or a logic error rate into the data stream.

Self Loop Indicates that the output is electronically looped back to the input.

Test Restart Clears out all accumulated results values and resumes accumulating values.

Help Provides on-line help for this configuration window.

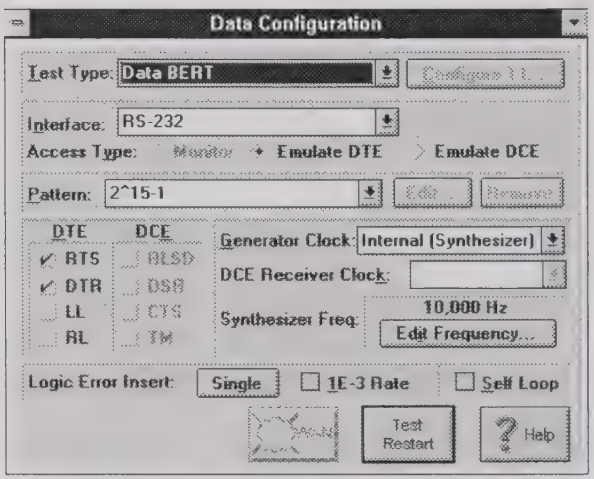

Figure 1-5
Data BERT Configuration Window

The Data status box indicates the current state of the status LEDs for the data circuit being tested. The LED status is grayed out if the status is not available for the current test configuration. The color of the status LED indicates the current or past condition of the associated function. Click on **Reset History** to determine whether the status is current or past history.

The Data Status LEDs are:

Pattern Sync Green when synchronization is achieved with the received data pattern.

Clock Present Green when clock transitions are detected.

Pattern Loss* Red when the pattern received is not what is expected or when 250 bit errors are detected in 1000 bits.

Clock Loss*		Red when clock transitions are not detected.
Data Loss*		Red when no longer receiving data transitions.
Pattern Slip*		Red when a portion of the received pseudorandom pattern is lost or has bits inserted into it.
No Gen Clock		Red when no signal transitions are detected at the selected generator clock source.
DCE:	**DTE:**	
RLSD	**DTE**	Yellow when asserted.
DSR	**RTS**	Yellow when asserted.
CTS	**DTR**	Yellow when asserted.
TM	**RL**	Yellow when asserted.

* A history status LED that illuminates when the associated event occurred in the past or is currently present. Clicking on **Reset History** clears the illuminated history LED if the event is no longer current.

The following list indicates the summary results for Data:

Bit errors
Pattern slips

1.5 SAMPLE SETUP FOR T1 TESTING

The following steps describe the basic setup for monitoring a T1 circuit. This is just a sample of one test setup that you can perform with the T1/Data Test Module. You can perform intrusive tests, non-intrusive tests, and configure the interface for WAN protocol testing via the T1/Data Test Module.

1. For our T1 BERT example, configure the T1 Configuration -Top Level window as follows:

Test Type	T1 BERT
T1 Mode	Full T1
Access	Receive Only
Analysis Port(s)	Line 1
Framing	SF (D4)
Input	Terminating

2. Click on **Results** in the menu bar to display the Results drop-down menu and click on **Customize Results...** to display the Result Setup window, shown in Figure 1-6.

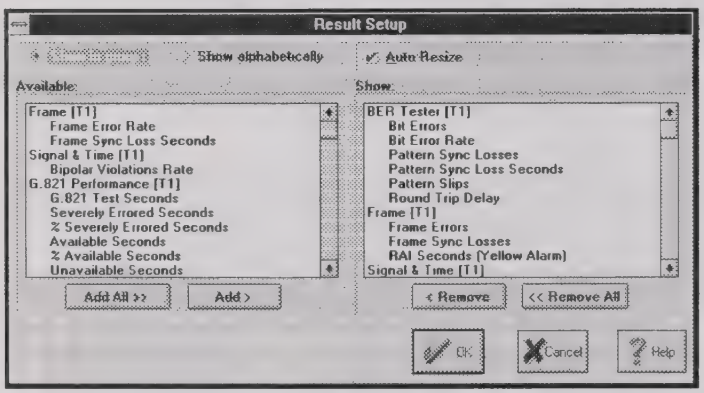

Figure 1-6
Result Setup Window

3. Observe that Bipolar Violations (BPVs) [T1] is displayed in the **Show:** listing. Include any other results that you want to have displayed (e.g., Bipolar Violation Rate) by clicking on a result displayed in the **Available:** listing to highlight it (you can use **Shift**-click to highlight several results at once), then click on **Add >** to add the highlighted result(s) to the **Show:** listing. You can also double-click on a result in the **Available:** listing to add it to the **Show:** listing.

4. Click on **OK** to accept the results setup and close the Result Setup window.

5. Click on **Test Restart** to clear accumulated results.

6. Observe that the displayed BPV result value is increasing. This verifies that the T1/Data module internal circuitry is working properly.

   Perform the following steps to begin monitoring data on the T1 circuit.

7. Set **Input** to DSX Mon.

8. Connect one end of the cable to Line 1 on the T1/Data module.

9. Connect the other end of the cable to the monitor jack of the T1 circuit you want to test.

10. Click on **Test Restart** to clear accumulated results and begin monitoring the T1 circuit.

11. Observe the T1 Status LEDs and verify that the Pattern Sync, Frame Sync, and Signal LEDs are green.

12. Observe the accumulating result(s).

1.6 LOGGING RESULTS

If desired, you can generate a log of accumulated results. Click on **Log**, in the menu bar, to display its drop-down menu and click on **Customize Log...**. This displays the Log Manager Setup window shown in Figure 1-7.

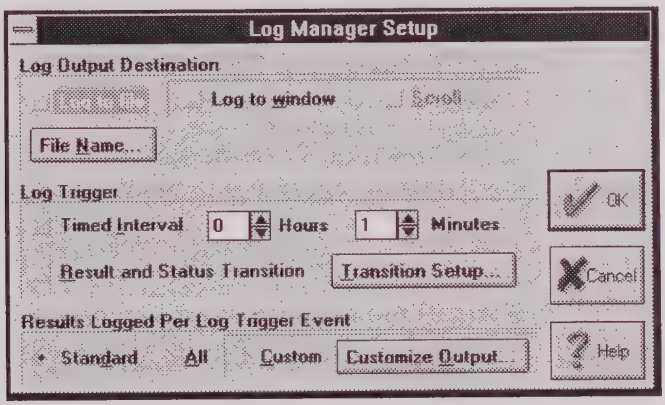

Figure 1-7
Log Manager Setup Window

With the Log Manager Setup window displayed, you can select where the log results are output. The log can be displayed on the screen or written to disk to be viewed or printed out at a later time. You can specify what causes a selected result to be logged — either time or result status. You can also specify what results are logged.

For example, to generate a log of the T1 BERT setup to the window, perform the following steps:

1. Click on **Log to window** (a check mark is visible in the box).

2. Click on **Scroll** (a check mark is visible in the box).

3. Click on **Result and Status transition** (a check mark is visible in the box).

4. Click on **Transition Setup...** to display the Log Transition Setup window (Figure 1-8).

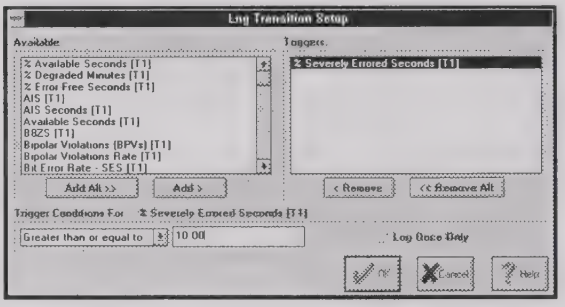

Figure 1-8
Log Transition Setup Window

5. In the Available column, locate and click on Bipolar Violations (BPVs) [T1] to highlight it.

6. Click on **Add >** and verify that Bipolar Violations (BPVs) [T1] appears in the Triggers list.

7. Click on Bipolar Violations (BPVs) [T1] in the Triggers list, and verify that Bipolar Violations (BPVs) [T1] appears next to **Trigger Conditions For**.

8. Click on the down arrow under **Trigger Conditions For**, and highlight **Greater than or equal to**.

9. Click on the value displayed to the right of the **Greater than or equal to** selection and enter **5**.

10. Click on **OK** to save the Log Transition Setup window selections and close it.

11. With the Log Manager Setup window displayed again, click on **OK** to save the selected Log Manager Setup selections and redisplay the T1 Configuration — Top Level window.

12. Click on the log icon in the toolbar to view the Log Display window.

13. Click on the BPV **Single** key 5 times and observe that an event is logged to the Log Display window shown in Figure 1-9.

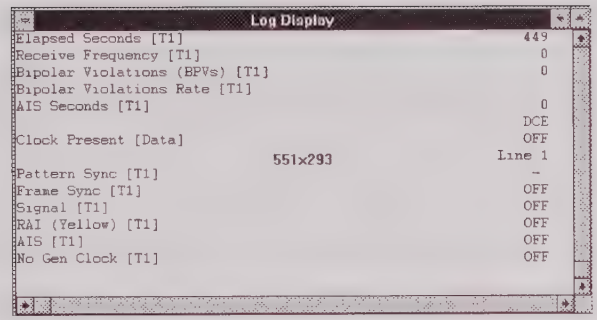

Figure 1-9
Log Display Window Example

1.7 OTHER T1/DATA APPLICATION WINDOW MENU SELECTIONS

Menu Choices

The T1/Data menus are displayed across the top of the T1/Data window. Click on the menu choices to display a drop-down list of available actions. The following is a list of choices available on the T1/Data menu bar:

File — establishes new configurations, saves the current configuration, recalls saved configurations, and provides other commonly used functions.

Test-Manager! — returns you to the Test Manager window.

Options — enables or disables the display of the toolbar, the information line, and the intrusive warning dialog box.

Action — restarts a test, halts information visible on the display, or initiates a demonstration mode.

Results — allows you to customize available results for the selected test configuration.

Log — allows you to customize a list of events and generate a log for the selected test configuration.

Window — controls how windows and icons are arranged.

Help — provides help and version information.

These menus are always available. You can click on the menu item to display a list of menu choices, or another window, when you click on **Test-Manager!**.

1.7.1 The File Menu

File menu choices allow you to perform T1/Data module configurations and file management functions that only affect the T1/Data module. Clicking on the File menu item displays the following menu choices:

Menu Item:	Shortcut:	Description:
New Test	**Ctrl + N**	Sets test setup to the default.
Open Test Setup...	**Ctrl + O**	Opens a previously saved test setup file. Displays the Open window.
Save Test Setup	**Ctrl + S**	Saves the current test setup.
Save Test Setup As...		Saves the current test setup in a new file.
User Info...		Edit user information.
Print/Report...	**Ctrl + P**	Generates a report or a print.
Exit	**Alt + F4**	Terminate application.

Select a **File** menu item by either highlighting the menu item, or by pressing the **Ctrl** key and underlined letter key simultaneously. For example, to open a test setup, press the **Ctrl** and **O** keys simultaneously.

The following paragraphs describe the menu choices available on the **File** menu items.

New Test — sets the T1/Data Test Module to its default condition. The default condition is determined by the FIREBERD 300/500 mainframe configuration. For example, with the WAN option installed, clicking on **New Test** displays the Data Configuration window in Data WAN Protocol Test Type.

Open Test Setup... — displays the Open window, where you can configure the T1/Data module as specified in the selected filename.

With the Open window displayed, you can specify the drive, the directory, the type of file, and the filename. This allows you to determine where the file is searched and what type of file is searched for. The default file extension for T1/Data configurations is .TDI.

You can also click on **Find File...** to find a file of specific interest. When doing so, the path searched is the path specified in the open configuration window. You cannot change the directory (the path searched) from the Find File Application window.

Save Test Setup — saves the current T1/Data configuration under the previously designated filename. When clicked on for the first time, the Open window is displayed, so you can designate the filename under which the current configuration is to be saved. When the current configuration has been saved, clicking on this menu item saves the current setup into the file with the same filename. The configuration information saved is only applicable to the T1/Data Test Module and does not apply to the entire mainframe. Previous information in the named file is overwritten.

Save Test Setup As... — saves the current T1/Data configuration under the filename you specify. Displays the Save As window where you specify the filename, directory, and drive. The configuration information saved is only applicable to the T1/Data Test Module and does not apply to the entire mainframe. T1/Data configuration files have a default file extension of .TDI to help you quickly identify configuration files.

User Info... — provides you with an electronic notepad that allows you to enter information of interest to you for the current configuration setup. To save the information that you have entered, you must save the current setup. Once saved, you can view this information by clicking on the file name in the Find File window, or by clicking on **User Info...** again. You can also use **User Info...** to help find a file.

Print/Report... — displays the Print/Report window, allowing you to generate a print or a report.

Exit — exits the T1/Data window and returns you to the Test Manager window.

1.7.2 Toolbar Icons

The icons displayed in the toolbar provide a quick way to access common Test Manager functions. These icons are:

Icon Button:	Description:	Function:
	Open Test Setup	Displays the Open window, allowing you to select the file you want to run. Performs the same action as clicking on **Open Test Setup...** on the **File** menu.
	Save Test Setup	Saves the current operating configuration. Clicking on this icon displays the Save As window the first time you want to save the current configuration. Subsequent saves overwrite previously saved information with the current configuration data. Performs the same action as clicking on **Save Test Setup** on the **File** menu.
	Configuration	Restores and activates the configuration window after it has been minimized.
	Status	Restores and activates the status window for the current configuration. The status window displayed is determined by the configuration that you have selected.

Icon Button:	Description:	Function:
	Result	Displays the results window for the current test. The results displayed are determined by the selected interface and by the results you choose to display. Results are selected by clicking on **Results** (from the T1/Data menu) and selecting the results you want to display.
	Log	Click on this icon to display the Log Display window, which displays the current log for the test in progress. Results logged are selected by clicking on **Customize Log...** on the **Log** menu and selecting the results that you want to have displayed.
	Restart	Restarts the test for the currently active interface. Performs the same action as clicking on the **Test Restart** key on the displayed configuration window.
 	STOP/GO	Enables/disables display hold. Clicking on this icon for the first time changes the sign from STOP to GO, indicating that the display hold is enabled. Display hold halts the updating of status results and displays the day, date, and time the display hold was initiated. While the updating of displayed results is halted, result values continue to accumulate. Clicking on GO enables the display of current results values, and displays STOP again. When STOP is displayed, it indicates that the display hold is disabled, allowing the results to display the current results values.

Depending on the selections made on Data Configuration and T1 Configuration Top Level window, up to 5 more icons may appear on the toolbar. Depending on the configuration window, the following icons can be seen on the toolbar:

Icon Button:	Description:
	Insert Single Logic Error (for Data)
	Insert Single Logic Error (for T1)
	Insert Single BPV Error
	Insert Single CRC Error
	Insert Single Frame Error

Clicking on these icons allows you to insert the associated error into the transmitted data stream without having to access the configuration window. You can click on these icons even if the T1 Configuration—Top Level window is minimized.

SECTION 2
T1/DATA TEST MODULE

2.1 SECTION OVERVIEW

This section provides an overview of the T1/Data Test Module operation, test module installation, and test module selection.

2.2 T1/DATA TEST MODULE OVERVIEW

The T1/Data Test Module (see Figure 2-1) provides the physical connection for T1/Data and WAN. In addition to providing the physical connection, the T1/Data module contains the circuitry to perform Physical Layer Bit Error Rate Testing (BERT) and to accumulate selected results for the circuit under test. The T1/Data Test Module plugs into any vacant slot in the FIREBERD 300/500 mainframe.

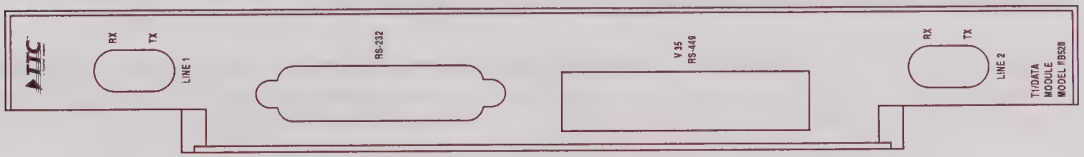

Figure 2-1
T1/Data Test Module

2.3 TEST MODULE INSTALLATION

You can install the T1/Data Test Module in any vacant slot in the mainframe as follows.

WARNING

TURN POWER OFF BEFORE INSERTING OR REMOVING TEST MODULES.

1. With the power turned off, install the T1/Data Test Module in a vacant slot in the FIREBERD 300/500 Internetwork Analyzer.

2. Insert the flanges, located at the top of the T1/Data Test Module, into guide rails located on the sides of the insertion slot.

3. Slowly slide the test module into the mainframe until properly seated in the mating connector.

   NOTE: When the test module is properly installed, the ejector handles (located on either side of the test module) are not sticking out, but are parallel with the test module front panel.

4. Turn the power ON.

5. If the test modules installed in the mainframe are the same as when power was turned off, the Test Manager window is displayed.

   NOTE: If the mainframe configuration is not the same as when power was turned off, you will need to run the Extended Industry Standard Architecture (EISA) configuration utility to reconfigure the mainframe resources. The following section describes the sequence of events that you will observe on the display if the mainframe configuration has changed.

2.3.1 EISA Configuration Utility

If the mainframe configuration (the number of test modules installed or their location) has been changed since the mainframe was last powered on, you must run the EISA configuration utility.

As part of the power-up sequence, the test modules installed and their configurations are checked according to the information saved when the mainframe was turned off. If the start-up configuration does not match the information stored, the following message is visible on the display:

```
The card in slot X does not match the EISA configuration.
```

The following line is also displayed requesting you to indicate the action that you want to perform:

```
Run EISA configuration utility [Y|n]
```

Press the **N** key if you do not want to perform the EISA configuration utility. Pressing the **N** key displays the C: prompt.

NOTE: The use of uppercase and lowercase letters for the selection is only for the purpose of indicating the default (uppercase letter) selection.

Press the **Y** key to begin the EISA configuration utility. When you do so, the following message is displayed during the loading:

```
Initializing.  Please wait...
```

At this point, the EISA configuration utility top-level window is displayed. Click on the down arrow to highlight the step to be performed.

```
Step 1:  About EISA Configuration
Step 2:  Add and Remove Boards
Step 3:  Change Configuration Settings
Step 4:  Save Configuration
Step 5:  View Switch/Jumper Settings
Step 6:  Exit
```

The following steps highlight the process to update the EISA configuration to reflect a changed mainframe configuration.

1. Press the down arrow key to highlight `Step 2:` (Add and Remove Boards).

2. Press the **Enter** key to display the `Step 2:` Add and Remove Boards window.

3. If the mainframe configuration is correct, press **Enter**. As a result, two display messages appear indicating that information is being read from the EISA nonvolatile memory and that it is being run in local configuration mode. After these messages appear, the Add Remove Board window is displayed.

4. When properly configured, press **Esc** to return to the EISA configuration utility top level window.

5. Press the down arrow key to highlight `Step 4:` (Save Configuration).

6. Press the **Enter** key to display the following message:

```
NOTE:  Configuration data has been stored in
EISA nonvolatile memory.  This configuration
data will not take effect until the system is
rebooted.  You may reboot the system now or
exit to DOS.

Do you really want to Exit?
```

7. Press **F10** to reboot.

The following message is displayed after a successful reboot of the system:

```
EISA configuration ... OK
```

When the EISA configuration utility has been successfully completed and the mainframe is properly configured, MS Windows is automatically started with the FIREBERD 300/500 Test Manager running.

2.4 T1/DATA CONNECTORS

Before performing any T1/Data test, you must first attach the mainframe to the circuit you want to monitor or test. Connectors located on the T1/Data module (see Figure 2-2) provide the physical interface to the circuit to be tested.

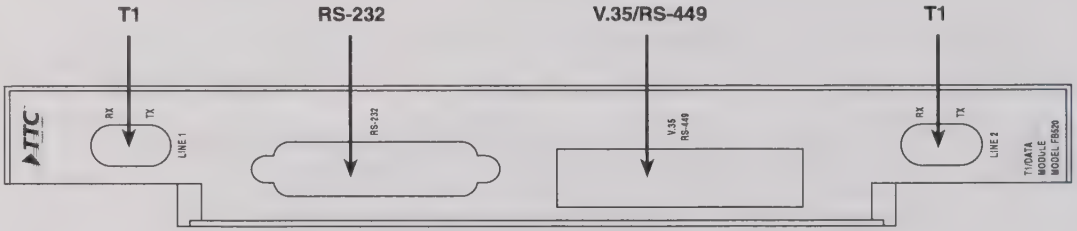

Figure 2-2
T1/Data Connectors Location

Attach a test cable from the circuit that you want to test to the appropriate connector on the T1/Data Test Module. Table 2-1 lists the T1/Data Test Module connectors.

Table 2-1
T1/Data Test Module Connectors

Type:	Description:	Qty:
Dual bantam jacks	T1	2
25-pin D-type connector	RS-232D	1
50-pin sub-miniature connector	V.35/RS-449	1

After connecting the cable(s) from the circuit to the T1/Data connector, you are ready to configure the FIREBERD Internetwork Analyzer for the type of test you want to perform.

2.5 TEST MODULE SELECTION

With the Test Manager window displayed, click on the T1/Data icon to activate the T1/Data Test Module. Once selected, the Data Configuration window is displayed.

As an alternative method of test module selection, you can also click on **Interfaces** in the menu bar, which offers a drop-down list of interfaces installed in the mainframe. Clicking on the desired interface name highlights and activates that interface.

Move the trackball to position the cursor pointer over the T1/Data icon and press the trackball selection button to display the default Data Configuration window. The FIREBERD 300/500 mainframe configuration determines the window that is displayed and the choices that are available on the displayed window. For example, if the WAN protocol module is installed, the Data Configuration window shown in Figure 2-3 is displayed.

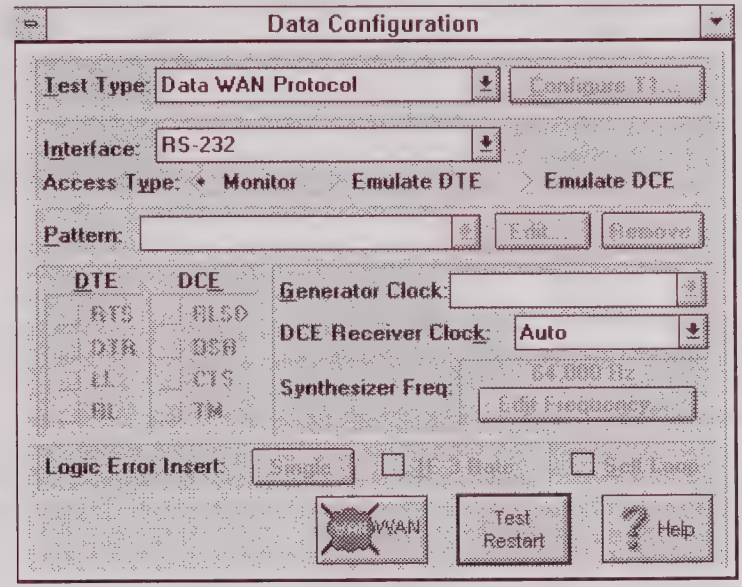

Figure 2-3
Default T1/Data Configuration Window

From the Data Configuration window, you can configure the T1/Data module for the tests you want to perform. The **Test Type** selected determines the configuration window that is displayed and the choices that are available on that window.

The type of testing to be performed determines the **Test Type** selection that you will make. The **Test Type** choices that are available are determined by the FIREBERD 300/500 mainframe configuration and the options installed (see Table 2-2). For example, if you have a mainframe that only has the T1/Data module installed, clicking on **Test Type** displays two choices (as shown in the third column). However, if the mainframe has the T1/Data and WAN modules installed, the **Test Type** has additional choices available (as shown in the fourth column).

Table 2-2
Test Type Choices Available

Data Only:	Data/WAN Only:	T1/Data Only:	T1/Data & WAN:
Data BERT	**Data WAN Protocol** **Data BERT**	**Data BERT** **T1 BERT**	**Data WAN Protocol** **Data & T1 WAN Protocol** **T1 WAN Protocol** **T1 ISDN PRI WAN Protocol** **Data BERT** **T1 BERT** **T1 ISDN PRI BERT**

2.6 NON-INTRUSIVE AND INTRUSIVE TESTING

As can be seen from the preceding list of choices, there are two basic test type choices: bit error rate tests (BERT), and protocol (WAN) tests. For each test type, you can perform non-intrusive or intrusive testing.

Performing a non-intrusive test allows you to attach to a circuit and monitor its activity. Non-intrusive tests allow you to observe traffic on a circuit, without interrupting data on that circuit or taking it out of operation, and accumulate results on that circuit. Non-intrusive testing techniques should be used to periodically ensure that a circuit is functioning properly. In this way, you can determine the health of a circuit and identify degradations in circuit quality before they become a real problem.

Non-intrusive testing is usually the first step in troubleshooting circuit problems, because it allows you to verify a problem does exist before you actually take a circuit out of operation. Once you have discovered a problem, you can perform an intrusive test to isolate the cause of the problem.

Intrusive testing allows you to insert data into the circuit under test, which allows you to insert specific patterns and known errors and measure the results. The T1/Data module offers a variety of standard test patterns, as well as the ability to create user-specified patterns. In addition to troubleshooting, intrusive tests can be used to ensure that a circuit will be able to handle a particular type of traffic or verify that newly installed equipment is properly optioned.

Even though you may have selected protocol testing, changing the access (from monitoring to emulating or inserting data) enables data to be inserted into the data stream. Because inserting data is intrusive, a dialog box appears indicating that you are about to perform an intrusive test. Clicking on **OK** makes the change, inserting data into the circuit under test. The actual data being inserted into the data stream is determined by the WAN module configuration. If the WAN module has not been configured, an "all 1's" pattern is inserted in the data stream. For example, with Data WAN Protocol selected, changing the **Access Type** to **Emulate DTE**, displays a dialog box stating that you are about to perform an intrusive test. Clicking on **OK** makes the access change; clicking on **Cancel** does not make the change and redisplays the configuration window.

NOTE: The intrusive warning dialog box can be turned off by clicking on **Options** to display the choices. Clicking on **Intrusive Warning** removes the check mark and prevents the intrusive warning dialog box from being displayed when an intrusive test it going to be performed.

2.7 WHAT'S NEXT?

Section 3 provides you with a quick look at the default T1/Data configuration window and the available choices. Sections 4 through 10 describe the following configuration windows and the choices available for each one. If an option is not installed, the described windows may not appear or may have choices grayed out. In order to access all the described windows and choices, be sure the FIREBERD 300/500 mainframe has the required module and software installed.

Test Type Selection:	Section:	Description:
Data WAN Protocol	4	Allows you to access WAN protocol analysis from a data (RS-232, V.35, or RS-449) access point. Gives you access to WAN protocol analysis when using a data interface.
Data & T1 WAN Protocol	5	Enables you to run the Data and T1 functions simultaneously and allows data to be passed to the WAN protocol for analysis.
T1 WAN Protocol	6	Allows you to access WAN protocol analysis from a T1 access point. Gives you access to WAN protocol analysis when using the T1 interface.
T1 ISDN PRI WAN Protocol	7	Allows you to analyze the 64 kb/s D-channel while performing analysis on a bearer channel.
Data BERT	8	Allows you to perform intrusive BER tests on data circuits. This selection is intrusive only, causing live data to be removed from the circuit under test.
T1 BERT	9	Allows you to perform intrusive BER tests or physical layer analysis on T1 circuits.
T1 ISDN PRI BERT	10	Allows you to perform WAN protocol analysis on the D-channel and BER tests on the bearer channel. BER tests are intrusive, removing live data from the circuit under test.

SECTION 3
T1/DATA CONFIGURATION WINDOWS

3.1 SECTION OVERVIEW

This section describes the Data Configuration and T1 Configuration - Top Level windows and describes the choices available for each one.

3.2 T1/DATA CONFIGURATION WINDOWS

The default configuration window displayed when the T1/Data icon is clicked on is determined by the mainframe configuration and the Test Type selection.

The FIREBERD 300/500 features configuration windows that allow you to quickly configure the T1/Data Test Module for the test you want to perform (see Figure 3-1). Each configuration window allows you to:

- Select the access type
- Configure the test interface
- Observe real-time status information
- Verify results
- Log events

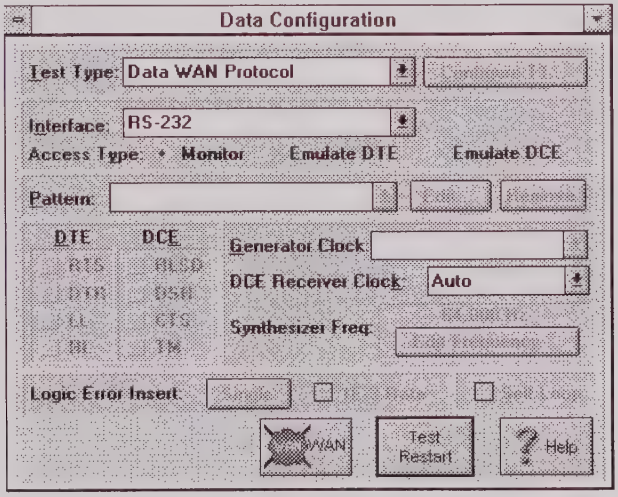

Figure 3-1
Data Configuration Window

The following paragraphs describe each top level configuration window and the choices available for each one. You will notice that several of the windows have the same configuration choices, but may have different selections available for those choices. Clicking on the down arrow (to the right of the **Test Type** selection) displays the available **Test Type** selections. For example, with **Test Type** set to T1 BERT, the following T1 Mode choices are available on the T1 Configuration - Top Level:

Full T1
Fractional T1
DDS (SW56)

Selecting **Full T1** as the **T1 Mode** provides the following **Framing** choices:

Unframed
SF (D4)
ESF

However, if you select **Fractional T1** as the **T1 Mode**, you have the following **Framing** choices:

SF (D4)
ESF

You will notice that, when you make menu item choices, you affect the other choices you can make. For example, with **Test Type** set to **T1 BERT** and **Access** set to **Receive Only**, you cannot insert errors or transmit patterns.

The following sections describe the configuration windows available for each of the following **Test Type** choices.

Data WAN Protocol
Data & T1 WAN Protocol
T1 WAN Protocol
T1 ISDN PRI WAN Protocol
Data BERT
T1 BERT
T1 ISDN PRI BERT

SECTION 4
DATA WAN PROTOCOL

4.1 SECTION OVERVIEW

This section describes the choices available when Data WAN Protocol is the **Test Type** selection.

4.2 DATA WAN PROTOCOL

Selecting **Data WAN Protocol** as the current **Test Type** displays the configuration window shown in Figure 4-1, which allows you to access WAN protocol analysis from a data (RS-232, V.35, or RS-449) access point.

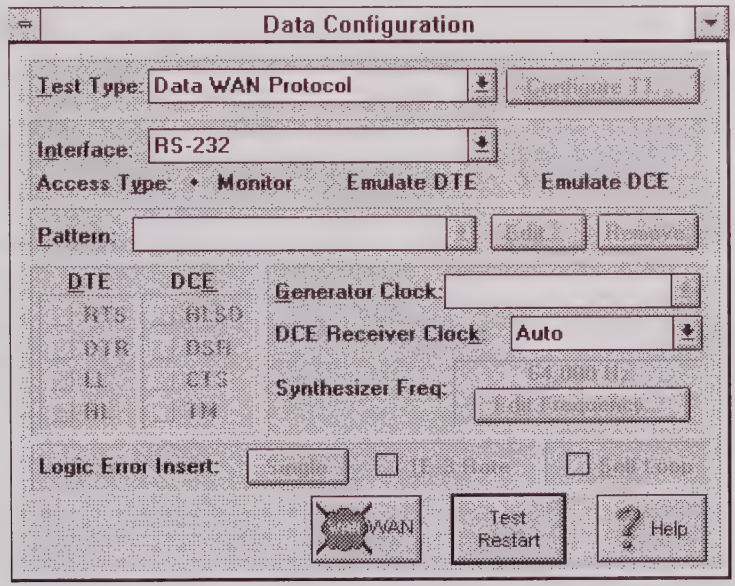

Figure 4-1
Data WAN Protocol Configuration Window

Interface — selects the physical connector that connects the test module with the circuit to be tested. This selection determines the electrical characteristics and interface parameters for the physical connector being used. **Interface** choices are:

V.35
V.35 (306 Timing)
RS232
RS449 (RS423)
RS449 (RS422 Terminated)
RS449 (RS422 Unterminated)

The **Interface** and **Access Type** selections determine the DTE/DCE signaling lead choices listed under DTE and DCE and determine the lead labels displayed in the Data Status window. The **Access Type** selection determines whether the DTE or DCE signaling lead choices are enabled.

Access Type — selects the type of access used when connecting to the circuit under test. Only one choice can be made at a time. Clicking on a selection makes that the current choice. **Access Type** choices include:

Monitor	Only allows data on the circuit to be monitored. This is a non-intrusive access type.
Emulate DTE	The test module emulates a DTE device. This is an intrusive test that allows you to emulate the test equipment side of the segment under test.
Emulate DCE	The test module emulates a DCE device. This is an intrusive test that allows you to emulate the network side of the segment under test.

If you change the **Access Type** from **Emulate DTE** to **Emulate DCE** or vice versa (for WAN protocol), a dialog box is displayed informing you that you are about to perform an intrusive test. Click on **OK** to allow the intrusive test change, or click on **Cancel**.

Pattern — is grayed out, since this selection is available only for BER tests.

DTE signaling lead group — emulates a DTE, allowing you to control the signaling leads of the selected data interface. Signaling leads can be set ON (a check mark) or OFF by clicking on the box or label. Clicking once on any DTE lead box or its label toggles the state of the signaling lead to its opposite condition. This selection is grayed out when **Access Type** is set to **Emulate DCE**.

The **Interface** selection (e.g., RS232, RS449, or V.35) determines the available DTE signaling leads. The following DTE lead choices are available for the listed Interface selection.

RS232/V.35	RS449
RTS - Request To Send	RS - Request To Send
DTR - Data Terminal Ready	TR - Terminal Ready
LL - Local Loopback	LL - Local Loopback
RL - Remote Loopback	RL - Remote Loopback

DCE signaling lead group — emulates a DCE, allowing you to control the signaling leads of the selected data interface. Signaling leads can be set ON (a check mark) or OFF by clicking on the box or label. Clicking once on any DCE lead box or its label toggles the state of the signaling lead to its opposite condition. This selection is grayed out when **Access Type** is set to **Emulate DTE**.

The **Interface** selection (e.g., RS232, RS449, or V.35) determines the available DCE signaling leads. The following DCE lead choices are available for the listed **Interface** selection.

RS232/V.35	RS449
RLSD - Received Line Signal Detect	RR - Receiver Ready
DSR - Data Set Ready	DM - Data Mode
CTS - Clear To Send	CS - Clear To Send
TM - Test Mode	TM - Test Mode

NOTE: The lead state can be toggled by clicking on the spacebar when it is highlighted.

Generator Clock — selects the source of timing for the generator clock. This selection is grayed out when **Access Type** is set to **Monitor**. When **Access Type** is set to **Emulate DTE** or **Emulate DCE**, the following choices are available:

Internal (Synthesizer) — Selects the internal frequency synthesizer as the transmit timing clock source. When selected, the **Synthesizer Freq** can be changed by clicking on **Edit Frequency...** and entering a frequency from 50 Hz to 10 MHz.

External (BNC) — Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω, and the signal needs to be a square wave from 1.5 V to 5.0 V peak-to-peak with a 0 V DC offset ±100 mV.

DCE Clock — Selects the received DCE clock as the transmit timing clock source (when **Access Type** is **Emulate DTE**).

DTE Clock — Selects the received DTE clock as the transmit timing clock source (when **Access Type** is **Emulate DCE**).

DCE Receiver Clock — selects the receiver clock source. This selection is not available when **Access Type** is set to **Emulate DTE**. However, when **Access Type** is set to **Emulate DCE**, the DCE receiver clock source choices are:

Auto — Allows software to automatically select the DCE receiver clock source. It does this by first selecting DTE Clock, and if it is not detected, it then defaults to DCE Clock.

DCE Clock — Selects the DCE clock source for the DCE receiver clock source.

DTE Clock — Selects the DTE clock source for the DCE receiver clock source.

Synthesizer Freq: — displays the synthesizer frequency generated when the **Generator Clock** is set to **Internal (Synthesizer)**. To change the displayed frequency, perform the following steps:

1. Click on **Edit Frequency...** to display the Synthesizer Frequency Setup window (Figure 4-2). The window displays a message indicating that the frequency synthesizer is a shared resource and may affect other modules in the mainframe.

2. Enter a synthesizer frequency (from 50 Hz to 10 MHz) using the keyboard keys.

3. Then click on **OK** to save the displayed frequency as the current synthesizer frequency.

NOTE: If you enter a frequency that is out of range, a dialog box is displayed stating such. Clicking on **OK** in this dialog box redisplays the Synthesizer Frequency Setup window, allowing you to enter another frequency or click on **Cancel** to return the synthesizer to its last valid frequency.

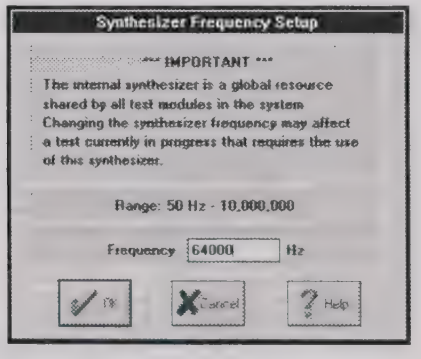
Synthesizer Frequency Setup
*** IMPORTANT ***
The internal synthesizer is a global resource shared by all test modules in the system. Changing the synthesizer frequency may affect a test currently in progress that requires the use of this synthesizer.
Range: 50 Hz - 10,000,000
Frequency
64000
Hz
OK
Cancel
Help

Figure 4-2
Synthesizer Frequency Setup Window

SECTION 5
DATA & T1 WAN PROTOCOL

5.1 SECTION OVERVIEW

This section describes the choices available when Data & T1 WAN Protocol is the **Test Type** selection.

5.2 DATA & T1 WAN PROTOCOL

Selecting **Data & T1 WAN Protocol** as the current **Test Type** displays the configuration window shown in Figure 5-1. This window enables you to combine data and T1 protocol analysis simultaneously and pass data to the WAN Test Module for analysis. You can simultaneously monitor data and T1 WAN with a dual port WAN analyzer.

Data is the default configuration window and is described first, with the T1 configuration described later.

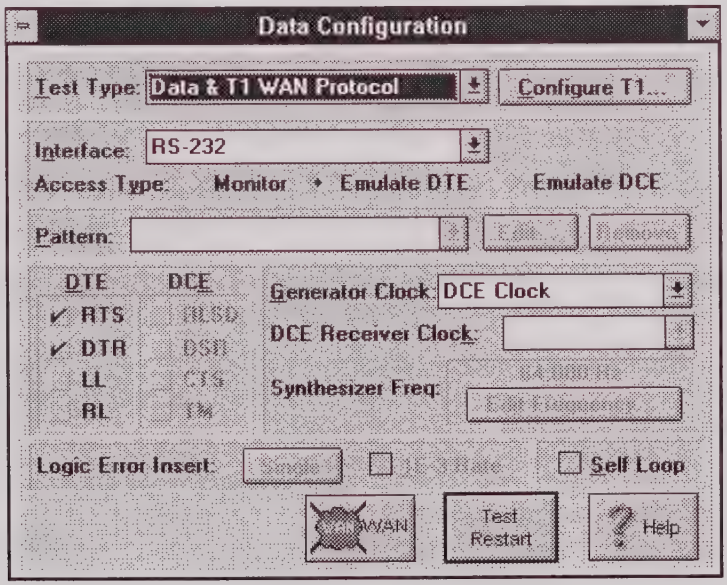

Figure 5-1
Data & T1 WAN Protocol Configuration Window

5.2.1 Data Configuration

The selections in the Data Configuration windows are as follows:

Interface — selects the physical connection between the test module and the circuit to be tested. This selection determines the electrical characteristics and physical interface parameters for the connector being used. When configuring the Data window, **Interface** choices are:

V.35
V.35 (306 Timing)
RS232
RS449 (RS423)
RS449 (RS422 Terminated)
RS449 (RS422 Unterminated)

The **Interface** and **Access Type** selections determine the DTE/DCE signaling lead choices listed under DTE and DCE and the lead labels displayed in the Data Status window. The **Access Type** selection determines whether the DTE or DCE signaling lead choices are enabled.

Access Type — selects the type of access used when connecting to the circuit you want to test. Only one choice can be made at a time. Clicking on a selection makes a choice current. **Access Type** choices include:

Monitor	Allows data on the circuit to be monitored. This is a non-intrusive access type.
Emulate DTE	The test module emulates a DTE device. This is an intrusive test that allows you to emulate the test equipment side of the segment under test.
Emulate DCE	The test module emulates a DCE device. This is an intrusive test that allows you to emulate the network side of the segment under test.

If you change the **Access Type** from **Emulate DTE** to **Emulate DCE** or vice versa (for Data WAN), a dialog box is displayed stating that you are about to perform an intrusive test. Click on **OK** to allow the intrusive test change, or click on **Cancel**.

NOTE: The pattern inserted is determined by the WAN application. If the WAN application has not been configured, the default pattern inserted is all ones.

Pattern — is grayed out, since this selection is available for only BER tests.

DTE signaling group — emulates a DTE, allowing you to set the signaling leads of the selected data interface. Signaling leads can be set ON (a check mark) or OFF by clicking on the box or label. Clicking once on any DTE lead box or label toggles the state of the signaling lead to its opposite condition.

The **Interface** selection (e.g., RS232, RS449, or V.35) determines the available DTE signaling leads. The following DTE lead choices are available for the listed **Interface** selection.

RS232/V.35	RS449(RS423)
RTS - Request To Send	RS - Request To Send
DTR - Data Terminal Ready	TR - Terminal Ready
LL - Local Loopback	LL - Local Loopback
RL - Remote Loopback	RL - Remote Loopback

DCE signaling group — emulates a DCE allowing you to control the signaling leads of the selected data interface. Signaling leads can be set ON (a check mark) or OFF by clicking on the box or label. Clicking once on any DCE lead box or its label toggles the state of the signaling lead to its opposite condition. This selection is grayed out when **Access Type** is set to **Emulate DTE**.

The **Interface** selection (e.g., RS232, RS449, or V.35) determines the available DCE signaling leads. The following DCE lead choices are available for the listed **Interface** selection.

RS232/V.35	RS449(RS423)
RLSD - Received Line Signal Detect	RR - Receiver Ready
DSR - Data Set Ready	DM - Data Mode
CTS - Clear To Send	CS - Clear To Send
TM - Test Mode	TM - Test Mode

NOTE: The lead state can be toggled by clicking on the spacebar when it is highlighted.

Generator Clock — selects the source of timing for the generator clock. This selection is grayed out when **Access Type** is set to **Monitor**. When **Access Type** is set to **Emulate DTE** or **Emulate DCE**, choices include:

Internal (Synthesizer) — Selects the internal frequency synthesizer as the transmit timing clock source. When selected, the **Synthesizer Freq** can be changed by clicking on **Edit Frequency...** and entering a frequency from 50 Hz to 10 MHz.

External (BNC) — Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω, and the signal needs to be a square wave from 1.5 V to 5.0 V peak-to-peak with a 0 V DC offset ±100 mV.

DCE Clock	Selects the received DCE clock as the transmit timing clock source (when **Access Type** is **Emulate DTE**).
DTE Clock	Selects the received DTE clock as the transmit timing clock source (when **Access Type** is **Emulate DCE**).

DCE Receiver Clock — selects the receiver clock source as follows:

Auto	Allows software to automatically select the DCE receiver clock source. It does this by first selecting DTE Clock; if it is not detected, it defaults to DCE Clock.
DCE Clock	Selects the DCE clock source for the DCE receiver clock source.
DTE Clock	Selects the DTE clock source for the DCE receiver clock source.

This selection is not available when **Access Type** is set to **Emulate DTE**.

Synthesizer Freq: — displays the synthesizer frequency generated when the **Generator Clock** is set to **Internal (Synthesizer)**. To change the displayed frequency, perform the following steps:

1. Click on **Edit Frequency...** to display the Synthesizer Frequency Setup window. The window displays a message indicating that the frequency synthesizer is a shared resource and may affect other modules in the mainframe.

2. Enter a synthesizer frequency (from 50 Hz to 10 MHz) using the keyboard keys.

3. Then click on **OK** to save the displayed frequency as the current synthesizer frequency.

NOTE: If you enter a frequency that is out of range, a dialog box is displayed telling you such. Clicking on **OK** in this dialog box redisplays the Synthesizer Frequency Setup window, allowing you to enter another frequency or click on **Cancel** to return the synthesizer to its last valid frequency.

5.2.2 T1 Configuration

Clicking on **Configure T1...** displays the T1 Configuration - Top Level window (see Figure 5-2). The following paragraphs describe the choices available in this window.

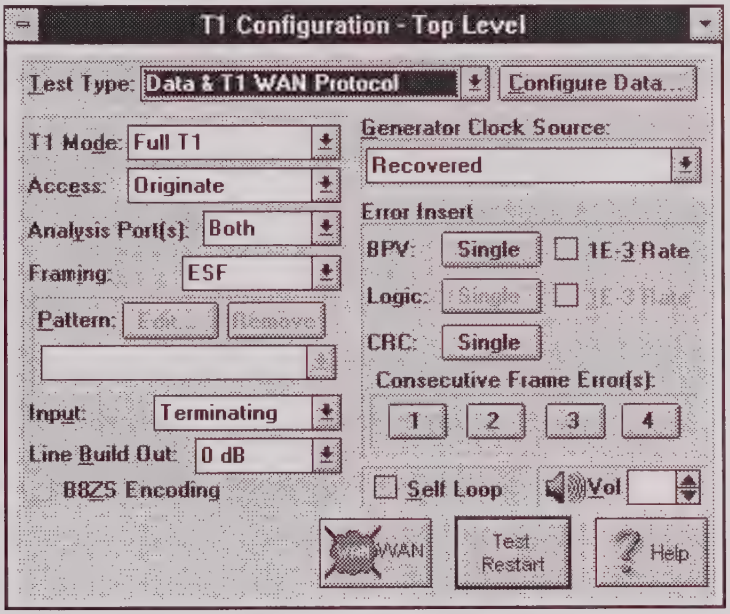

Figure 5-2
T1 Configuration - Top Level Window

T1 Mode — selects the T1 mode of operation. The **T1 Mode** selection determines which additional selections are available at the bottom of the window, as follows:

Full T1	No other windows available
Fractional T1	Fractional T1 window available

Access — selects the type of access used to conduct the test. Choices are:

Receive Only	Monitor only. Used for non-intrusive testing, and only allows analysis of received data.
Originate	Transmit and receive. Used for intrusive testing when transmitting and receiving data.

Drop & Insert — Receive and transmit. Used for selecting one or more channels to be dropped from the T1 circuit under test. Channels not selected are allowed to pass through. This selection is not available when **T1 Mode** is set to **Full T1**.

Analysis Port (s) — selects the port (i.e., connector) for analysis and transmission of data. Choices are:

Both Ports — Allows data to be received on both ports simultaneously. Analysis of data (excluding BERT) on both ports is performed at the same time. Results provided includes frame errors, CRC errors, receive frequency, etc.

Line 1 — Performs analysis on the port from the CPE side.

Line 2 — Performs analysis on the port from the network side.

Framing — selects the type of framing expected on the received signal and the format selected when transmitting. Choices are:

Unframed — Transmit and receive unframed data. Since no framing bits are expected, no data bits are stripped from the received data. This selection is only available when **T1 Mode** is set to **Full T1**.

SF (D4) — Transmit and receive T1 signals with D4 (Superframe) framing. SF framing occupies 8 kb/s of the 1.544 Mb/s bandwidth with the data occupying the remaining 1.536 Mb/s. SF framing is compatible with D1D, D2, D3, and D4 channel banks.

ESF — Transmit and receive T1 signals with Extended SuperFrame (ESF) framing format. ESF framing occupies 2 kb/s, CRC occupies 2 kb/s, and the datalink occupies 4 kb/s with the data occupying the remaining 1.536 Mb/s.

Pattern — is grayed out, since this selection is available for only BER tests.

Input — selects the input impedance for the unit. Choices are:

Terminating — Provides 100Ω input impedance to a properly terminated line. Accepts T1 signals between +6 dB and -35 dB (or -24 dB in the presence of jitter, as per PUB62411) and provides compensation for cable loss.

DSX Monitor — Provides 100Ω input impedance to a properly terminated line. Accepts T1 signals that have been resistively attenuated between 10 dB and 30 dB at the monitor jack.

Bridging — Provides >1 kΩ input impedance to a properly terminated line.

Line Build Out — selects the line build-out signal reduction. Choices are:

0 dB	Sets the transmit (Tx) output to the DSX level with no line build-out.
-7.5 dB	Provides -7.5 dB line build-out, thus simulating 7.5 dB of attenuation due to cable loss.
-15 dB	Provides -15 dB line build-out, thus simulating 15 dB of attenuation due to cable loss.

This selection is not available when **Access** is set to **Receive Only**.

B8ZS Encoding — selects whether or not B8ZS encoding is used on transmitted data. Clicking on the box or label toggles the B8ZS encoding selection to its opposite condition.

This selection is not available when **Access** is set to **Receive Only**.

Generator Clock Source — selects the timing source for the generator clock. Choices are:

Internal (1.544 MHz Fixed)	Selects the internal oscillator as the generator clock source for transmit timing. The internal oscillator has a frequency accuracy of ±10 ppm.
External (BNC)	Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω, and the signal needs to be a square wave from 1.5 V to 5.0 V peak-to-peak with a 0 V DC offset ±100 mV.
Recovered	The generator clock is recovered from the received signal on the same line.
Recovered (Opposite)	The generator clock source is recovered from the opposite T1 line. This selection is required for Drop & Insert.

This selection is not available when **Access** is set to **Receive Only**.

Error Insert — allows errors to be entered at different error rates into the data stream. The following errors can be inserted into the data stream by clicking on the **Single** key or by clicking on the rate box, if available:

BPV (bipolar violation)	Single or 1E-3. Clicking on **Single** inserts a single error into the data stream (by inverting the polarity of the 1 bit, causing a bipolar violation). Clicking on **1E-3** inserts 1 BPV error for every 1000 bits when a check mark is in the box.

CRC	A single Cyclic Redundancy Check error is inserted each time **Single** is clicked on. CRC errors do not cause bit errors. CRC errors can only be inserted when **Framing** is set to **ESF**.

Consecutive Frame Error(s) — selects the number of adjacent frames that are errored. Choices are:

1	inserts a bit error in 1 frame in the transmitted data stream.
2	inserts a bit error in 2 consecutive frames in the transmitted data stream.
3	inserts a bit error in 3 consecutive frames in the transmitted data stream.
4	inserts a bit error in 4 consecutive frames in the transmitted data stream.

NOTE: Generating 2, 3, or 4 consecutive frame errors causes frame synchronization loss.

In addition to inserting errors on the T1 Configuration - Top Level window, error insert switch icons are included on the toolbar. These icon switches perform the same function as the corresponding **Single** switch. Clicking on the error insert switch icon inserts a single error of that type into the transmitted data stream. The error insert switch icons are grayed out if that error insert type is not allowed for the test being performed. Error insert switch icons include:

T1 BPV Err	inserts a single bipolar violation error in the transmitted data stream.
T1 CRC Err	inserts a single CRC error in the transmitted data stream.
T1 Frame Err	inserts a single frame error in the transmitted data stream.

These selections are grayed out when **Access** is set to **Receive Only**.

Self Loop — selects the self-loop mode. In this mode, you can test the transmitter and receiver circuits of the selected T1 interface before connecting the test instrument to a circuit. The self-loop mode allows you to verify proper interface operation without disrupting any traffic on the line. Clicking once on **Self Loop** toggles it to its opposite condition (ON or OFF). This selection is not available when **Access** is set to **Receive Only**.

NOTE: When in self-loop mode, the use of "drop dead" relays allows T1 data to pass through when in the drop and insert configuration.

Help — allows context-sensitive help to be displayed for the current window.

WAN — activates the WAN Protocol application.

Test Restart — clears all accumulated test results, starts accumulating result totals, and displays the Results window.

5.3 FRACTIONAL T1

With **T1 Mode** set to **Fractional T1**, the **Fractional T1...** button is displayed near the bottom left corner of the configuration window. Clicking on the **Fractional T1...** button displays the Fractional T1 Configuration window (Figure 5-3), allowing you to:

- Configure the data rate for either 56 or 64 kbps
- Select the individual DS1 channel(s) to be received or transmitted for both Line 1 and 2

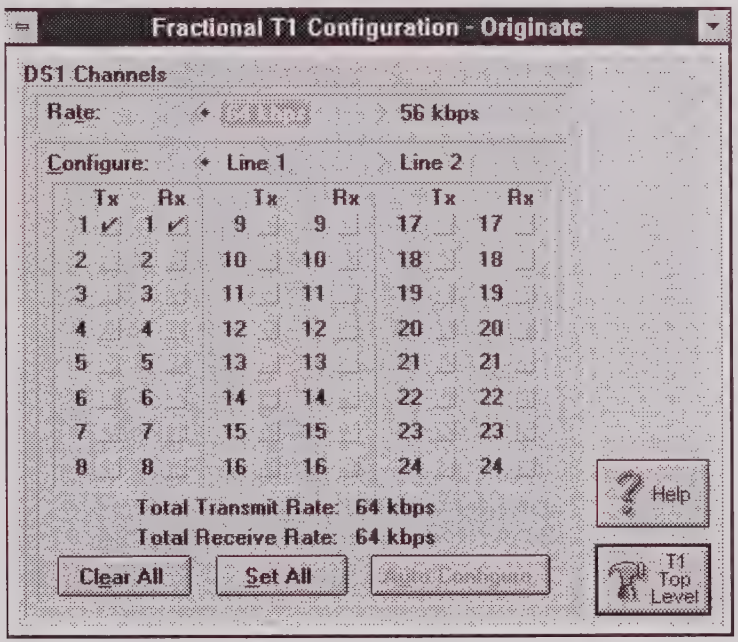

Figure 5-3
Fractional Configuration Window

Rate — selects the DS1 channel data rate (64 kbps or 56 kbps).

Configure — shows the **Analysis Port(s)** selection (Line 1 or Line 2), on the T1 Configuration - Top Level window, for which the DS1 channels are configured. When set to **Both**, you can use the radio buttons to select which line configuration is displayed for modification. The DS1 channel configuration choices are determined by the T1 Configuration – Top Level window settings. For example, when **Access** is set to **Originate**, configuring the Tx and Rx channels allows data to be inserted for the selected line (Line 1 or Line 2) for each channel.

However, if **Access** is set to **Drop & Insert**, data is dropped from, and inserted into, the selected analysis port as configured (Tx = insert, Rx = drop); see Figure 5-4. When no Tx boxes have a check mark in them, data is passing through the T1 test module: Line 1 Rx to Line 2 Tx, Line 2 Rx to Line 1 Tx. Selecting Tx channels overwrites the selected channels at the analysis port with data from the WAN card. For the non-analysis port, these same channels are overwritten with the idle code. The dropped channels are overwritten on their Tx channels with the idle code (01111111) on the other line, while allowing unselected channels to pass through unaffected, and prevents loop codes or other test patterns from being transmitted over the network. Thus, when you configure the selected line, the other line is automatically configured to keep data on the dropped/inserted channels from being sent across the network.

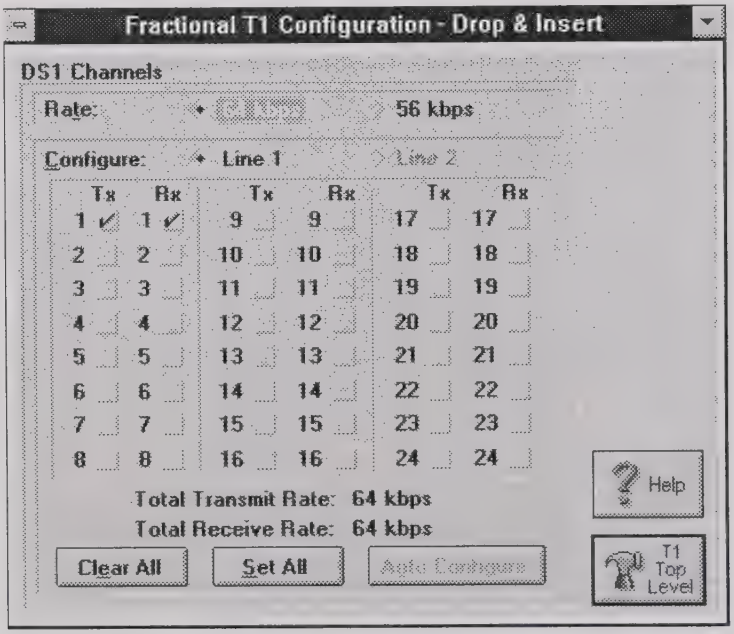
Fractional T1 Configuration - Drop & Insert
DS1 Channels
Rate:
56 kbps
Configure:
Line 1
Line 2
Tx Rx Tx Rx Tx Rx
1 1 9 9 17 17
2 2 10 10 18 18
3 3 11 11 19 19
4 4 12 12 20 20
5 5 13 13 21 21
6 6 14 14 22 22
7 7 15 15 23 23
8 8 16 16 24 24
Total Transmit Rate: 64 kbps
Total Receive Rate: 64 kbps
Clear All
Set All
Auto Configure
Help
T1 Top Level

Figure 5-4
Drop & Insert Window

Tx/Rx — selects the individual DS1 channels and determines whether transmit (Tx), receive (Rx), or both, are enabled. Clicking on either the channel number or its box enables or disables the selected channel.

Total Transmit Rate: — displays the aggregate data rate for all enabled (selected) Tx channels. Each time a DS1 Tx channel is enabled or disabled, the value of Total Transmit Rate changes accordingly. The maximum value for Total Transmit Rate is determined by the selected data rate and the number of transmit (Tx) channels selected. Assuming all channels are selected for 64 kbps, the maximum rate is 1536 kbps, or 1344 kbps for the 56 kbps rate when all channels are selected.

Total Receive Rate: — displays the aggregate data rate for all enabled (selected) Rx channels. Each time a **DS1** Rx channel is enabled or disabled, the value of Total Receive Rate changes accordingly. The maximum value for Total Receive Rate is determined by the selected data rate and the number of receive (Rx) channels selected. Assuming all channels selected for 64 kbps, the maximum rate is 1536 kbps, or 1344 kbps for the 56 kbps rate when all channels are selected.

Clear All — disables all selected Tx and Rx channels, clears all check marks, and sets the Total Transmit Rate and Total Receive Rate to 0 kbps.

Set All — enables all Tx and Rx channels, inserts a check mark next to all Tx and Rx channels, and sets the Total Transmit Rate and Total Receive Rate to its maximum value for the selected data rate.

Help — allows context-sensitive help to be displayed for the T1 Configuration window for the selected function.

T1 Top Level — exits the Fractional T1 Configuration window and redisplays the T1 Configuration - Top Level window.

SECTION 6
T1 WAN PROTOCOL

6.1 SECTION OVERVIEW

This section describes the choices available when T1 WAN Protocol is the **Test Type** selection.

6.2 T1 WAN PROTOCOL

Selecting **T1 WAN Protocol** as the current **Test Type** displays the configuration window shown in Figure 6-1, which allows you to access WAN protocol analysis from a T1 access point.

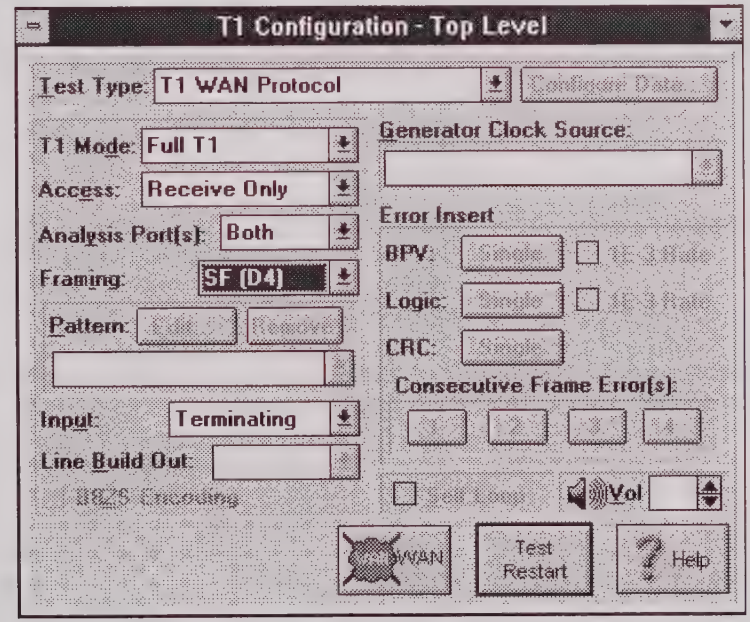

Figure 6-1
T1 WAN Protocol Configuration Window

T1 Mode — selects the mode of T1 operation. The **T1 Mode** selection determines the choice available at the bottom of the window (e.g., Fractional T1..., DDS (SW56)..., or DDS (DS0A/B)...) used to display another window. **T1 Mode** choices are:

T1 Mode Selection:	Other Windows Available:
Full T1	No other window available
Fractional T1	Fractional T1... window available
DDS (SW56)	DDS (SW56)... window available
DDS DS0A/B	DDS (DS0A/B)... window available
ESF Data Link	No other window available
FAD	FAD... window available
TAD	TAD... window available

Access — selects the type of access used to conduct the test. The **Access** selections available are determined by the T1 Mode selection. Choices are:

Receive Only	Monitor only. Used for non-intrusive testing, and only allows analysis of received data.
Originate	Transmit and receive. Used for intrusive testing when transmitting and receiving data.
Drop & Insert	Receive and transmit. Used for in-service testing when one or more channels are to be dropped for analysis, while the unselected channels pass through. This selection is not available when **T1 Mode** is set to **Full T1**.

Analysis Port(s) — selects the port(s) for analysis and transmission of data. **Analysis Port(s)** selections are determined by the **Access** selection. Choices are:

Both	Allows data to be received and transmitted on both ports simultaneously. Analysis of data on both ports is performed at the same time, but BERT testing is not performed. Results provided include frame errors, CRC errors, receive frequency, etc.
Line 1	Performs analysis on the port typically connected to the DCE (network). Line 1 should be connected to the DCE side.
Line 2	Performs analysis on the port typically connected to the DTE (customer) side. Line 2 should be connected to the DTE side.

The following list shows the availability of this selection.

Full T1		Fractional T1		DDS (SW56)		DDS (DS0A/B)		ESF Data Link	
R O	B/1/2	R O	B/1/2	——	——	R O	B/1/2	R O	B/1/2
Orig	B/1/2	Orig	B/1/2	Orig	1/2	Orig	1/2	Orig	1/2
——	——	D & I	1/2	D & I	1/2	D & I	1/2	D & I	1/2

Legend

Access	Analysis Port(s)
R O = Receive Only	B = Both
Orig = Originate	1 = Line 1
D & I = Drop & Insert	2 = Line 2

Framing — indicates the type of framing expected on the received signal and the format selected when transmitting. Choices are:

Unframed — Receive unframed data. Since no framing bits are expected, no data bits are stripped from the received data. This selection is only available when **T1 Mode** is set to **Full T1**.

SF (D4) — Receive T1 signals with D4 (Superframe) framing. SF framing occupies 8 kb/s of the 1.544 Mb/s bandwidth, with the data occupying the remaining 1.536 Mb/s. SF framing is compatible with D1D, D2, D3, and D4 channel banks.

ESF — Receive T1 signals with Extended SuperFrame (ESF) framing format. ESF framing occupies 2 kb/s, CRC occupies 2 kb/s, and the data link occupies 4 kb/s, with the data occupying the remaining 1.536 Mb/s.

Pattern — is grayed out, since this selection is available for only BER tests.

Input — selects the input impedance for the interface. Choices are:

Terminating — Provides 100Ω input impedance to a properly terminated line. Accepts T1 signals between +6 dB and -35 dB (or -24 dB in the presence of jitter, as per PUB62411) and provides compensation for cable loss.

DSX Monitor — Provides 100Ω input impedance to a properly terminated line. Accepts T1 signals that have been resistively attenuated between 10 dB and 30 dB at the monitor jack.

Bridging — Provides >1 kΩ input impedance to a properly terminated line.

Line Build Out — selects the line build-out signal reduction. Choices are:

0 dB	Sets the transmit (Tx) output to the DSX level with no line build-out.
-7.5 dB	Provides -7.5 dB line build-out, thus simulating 7.5 dB of attenuation due to cable loss.
-15 dB	Provides -15 dB line build-out, thus simulating 15 dB of attenuation due to cable loss.

This selection is not available when **Access** is set to **Receive Only**.

B8ZS Encoding — selects whether or not B8ZS encoding is used on transmitted data. Clicking on the box or label enables or disables the B8ZS encoding selection. This selection is not available when **Access** is set to **Receive Only**.

Generator Clock Source — selects the timing source for the generator clock. Choices are:

Internal (1.544 MHz Fixed)	Selects the internal oscillator as the generator clock source for transmit timing. The internal oscillator has a frequency accuracy of ±10 ppm.
External (BNC)	Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω, and the signal needs to be a square wave from 1.5 V to 5.0 V peak-to-peak with a 0 V DC offset ±100 mV.
Recovered	The generator clock is recovered from the received signal on the same line.
Recovered (Opposite)	The generator clock source is recovered from the opposite T1 line. This selection is required for Drop & Insert.

This selection is not available when **Access** is set to **Receive Only**.

Error Insert — allows errors to be entered at different error rates into the data stream. The following errors can be inserted into the data stream by clicking on the **Single** key or by clicking on the rate box, if available:

BPV (bipolar violation)	Single or 1E-3. Clicking on **Single** inserts a single error into the data stream (by inverting the polarity of the 1 bit, causing a bipolar violation). Clicking on **1E-3** inserts 1 BPV error for every 1000 bits when a check mark is in the box.

CRC	A single Cyclic Redundancy Check error is inserted each time **Single** is clicked on. CRC errors do not cause bit errors. CRC errors can only be inserted when **Framing** is set to **ESF**.

Consecutive Frame Error(s) — selects the number of adjacent frames that are errored. Choices are:

1	inserts a bit error in 1 frame in the transmitted data stream.
2	inserts a bit error in 2 consecutive frames in the transmitted data stream.
3	inserts a bit error in 3 consecutive frames in the transmitted data stream.
4	inserts a bit error in 4 consecutive frames in the transmitted data stream.

NOTE: Generating 2, 3, or 4 consecutive frame errors causes frame synchronization loss.

In addition to inserting errors on the T1 Configuration - Top Level window, error insert switch icons are included on the toolbar. Clicking on the error switch icon inserts a single error of that type into the transmitted data stream. The error insert switch icons are grayed out if that error insert type is not allowed for the test being performed. Error insert switch icons include:

T1 BPV Err	inserts a single bipolar violation error in the transmitted data stream.
T1 CRC Err	inserts a single CRC error in the transmitted data stream.
T1 Frame Err	inserts a single frame error in the transmitted data stream.

These selections are grayed out when **Access** is set to **Receive Only**.

Self Loop — selects the self-loop mode. In this mode, you can test the transmitter and receiver circuits of the selected T1 interface before connecting the test instrument to a circuit. The self-loop mode allows the user to verify proper interface operation without disrupting any traffic on the line. Clicking once on **Self Loop** toggles it to its opposite condition (ON or OFF).

NOTE: When in self loop, the use of "drop dead" relays allows T1 data to pass through when in the drop and insert configuration.

This selection is not available when **Access** is set to **Receive Only**.

Help — allows context-sensitive help to be displayed for the current window.

WAN — activates the WAN Protocol application.

Test Restart — clears all accumulated test results, starts accumulating results totals, and displays the Results window.

6.3 FRACTIONAL T1

With **T1 Mode** set to **Fractional T1**, the **Fractional T1...** button is displayed near the bottom left corner of the configuration window. Clicking on the **Fractional T1...** button displays the Fractional T1 Configuration window (Figure 6-2), allowing you to:

- Configure the data rate for either 56 or 64 kbps
- Select the individual DS1 channel(s) to be received or transmitted for both Line 1 and 2

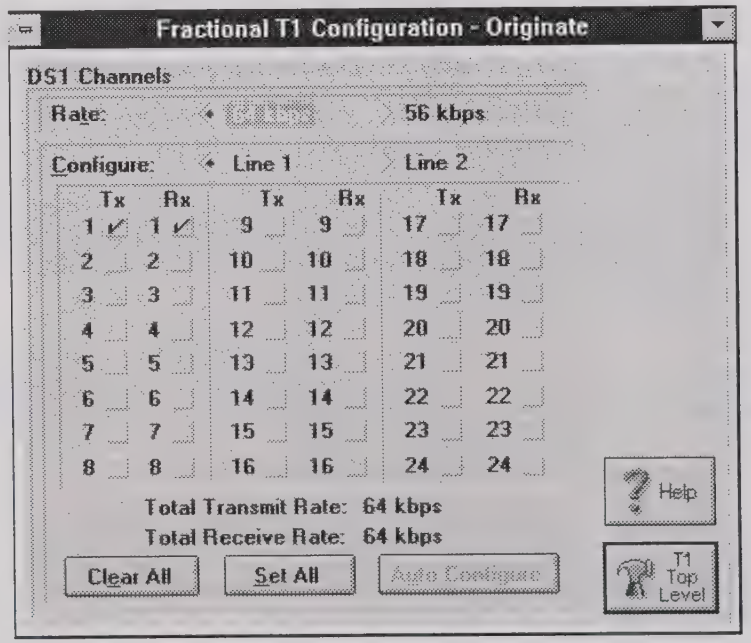

Figure 6-2
Fractional T1 Configuration Window

Rate — selects the DS1 channel data rate (64 kbps or 56 kbps).

Configure — shows the **Analysis Port(s)** selection (Line 1 or Line 2), on the T1 Configuration - Top Level window, for which the DS1 channels are configured. When set to **Both**, you can use the radio buttons to select which line configuration is displayed for modification. The DS1 channel configuration functions are determined by the T1 Configuration - Top Level window settings. For example, when **Access** is set to **Originate**, configuring the Tx and Rx channels allows data to be inserted for the selected line as shown for each channel.

However, if **Access** is set to **Drop & Insert**, data is dropped from, and inserted into, the selected analysis port as configured (Tx = insert, Rx = drop) when no Tx boxes have a check mark in them, data is passing through the T1 test module: Line 1 Rx to Line 2 Tx, Line 2 Rx to Line 1 Tx (see Figure 6-3). Selecting Tx channels overwrites the selected channels at the analysis port with data from the WAN card. For the non-analysis port, these same channels are overwritten with the idle code. The dropped channels are overwritten on their Tx channels with the idle code (01111111) on the other line, while allowing unselected channels to pass through unaffected, and prevent loop codes or other test patterns from being transmitted over the network. Thus, when you configure the selected line, the other line is automatically configured to keep data on the dropped/inserted channels from being sent across the network.

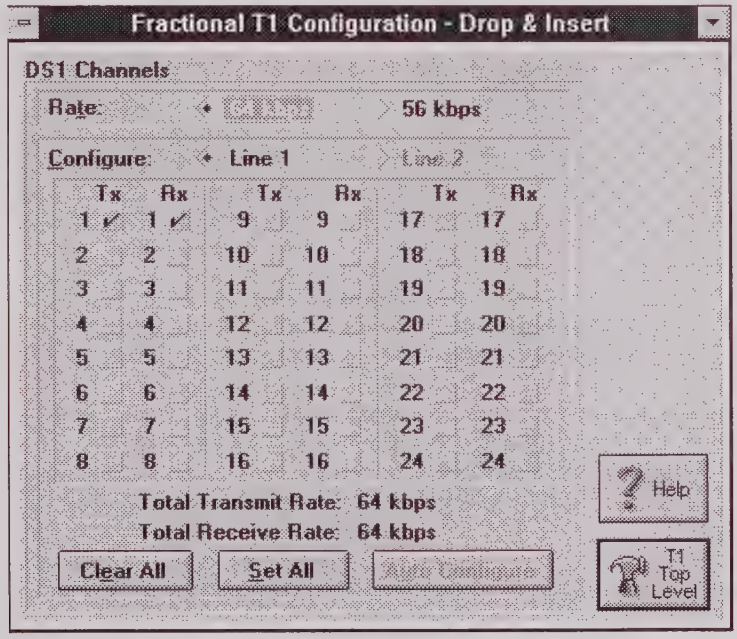
Fractional T1 Configuration - Drop & Insert
DS1 Channels
Rate:
56 kbps
Configure:
Line 1
Line 2
Tx Rx Tx Rx Tx Rx
1 1 9 9 17 17
2 2 10 10 18 18
3 3 11 11 19 19
4 4 12 12 20 20
5 5 13 13 21 21
6 6 14 14 22 22
7 7 15 15 23 23
8 8 16 16 24 24
Total Transmit Rate: 64 kbps
Total Receive Rate: 64 kbps
Clear All
Set All
Help
T1 Top Level

Figure 6-3
Drop & Insert Window

Tx/Rx — selects the individual DS1 channels and determines whether transmit (Tx), receive (Rx), or both, are enabled. Clicking on either the channel number or its box enables or disables the selected channel.

Total Transmit Rate: — displays the aggregate data rate for all enabled (selected) Tx channels. Each time a DS1 Tx channel is enabled or disabled, the value of Total Transmit Rate changes accordingly. The maximum value for Total Transmit Rate is determined by the selected data rate and the number of transmit (Tx) channels selected. Assuming all channels are selected for 64 kbps, the maximum rate is 1536 kbps, or 1344 kbps for 56 kbps rate when all channels are selected.

Total Receive Rate: — displays the aggregate data rate for all enabled (selected) Rx channels. Each time a DS1 Rx channel is enabled or disabled, the value of Total Receive Rate changes accordingly. The maximum value for Total Receive Rate is determined by the selected data rate and the number of receive (Rx) channels selected. Assuming all channels are selected for 64 kbps, the maximum rate is 1536 kbps, or 1344 kbps for 56 kbps rate when all channels are selected.

Clear All — disables all selected Tx and Rx channels, clears all check marks, and sets the Total Transmit Rate and Total Receive Rate to 0 kbps.

Set All — enables all Tx and Rx channels, inserts a check mark next to all Tx and Rx channels, and also sets the Total Transmit Rate and Total Receive Rate to its maximum value for the selected data rate.

Help — allows context-sensitive help to be displayed for the T1 Configuration window for the selected function.

T1 Top Level — exits the Fractional T1 Configuration window and redisplays the T1 Configuration - Top Level window.

6.4 DDS (SW 56)

When **T1 Mode** is set to **DDS (SW56)**, the **DDS (SW56)...** box is visible near the bottom left corner of the configuration window. Clicking on **DDS (SW56)...** displays the T1 Switched 56 (DDS) window.

DDS Switched 56 operates as a monitoring device or as an emulating device. The following sections describe the different switched 56 windows and modes of operation.

6.4.1 Emulation Mode

In emulation mode, you can configure the interface as either an originating or terminating device and establish the connection sequence. When emulating an originating device, you can generate a sequence of transmit and receive events to initiate a dial-up connection. When emulating a terminating device, you can generate a sequence of transmit and receive events designed to accept an incoming call.

Emulation mode is selected when:

1. **T1 Mode** is set to **DDS (SW 56)**.
2. **Access** is set to **Originate** or to **Drop & Insert**.

Clicking on **DDS (SW 56)...** displays the T1 Switched 56 (DDS) — Emulation Mode window, as shown in Figure 6-4.

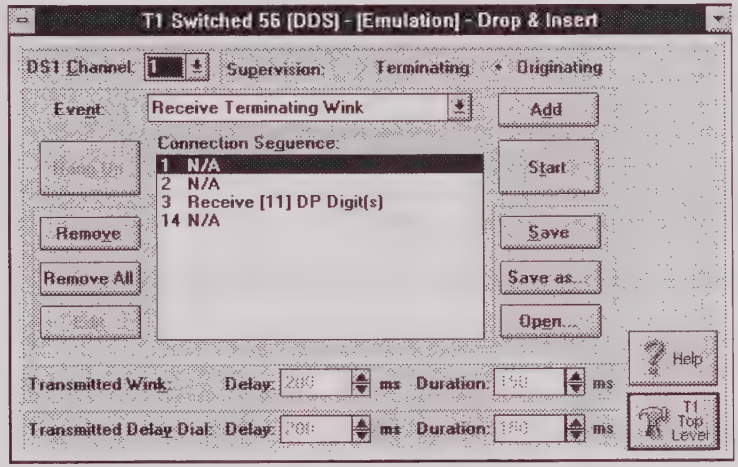

Figure 6-4
T1 Switched 56 (DDS) - Emulation Mode Window

With this window displayed, you can specify the DS1 channel and the type of supervision, and then either enter a series of events, or recall a previously saved sequence of events. The **Start**, **Hang Up**, **Remove**, **Remove All**, **Edit**, **Save**, and **Save as...** keys are grayed out until you add an event to the Connection Sequence box. Once an event has been added, all keys are available (except for **Hang Up** and **Edit**).

To add an event to the Connection Sequence box, do the following:

1. Click on the down arrow for Event to see the choices available for the selected Supervision (Terminating or Originating).

2. Highlight the desired event.

3. Click on **Add** to add that event to the sequence of events.

4. Click on **Start** to initiate the sequence of events that you entered and display the SW56 Events window, which shows you the event sequence status.

When you click on **Start**, an on-hook is transmitted for 2 seconds to clear the line (only when the Supervision selection is Originating). After the on-hook is transmitted, the event sequence is stepped through.

The transmit events are generated and receive events are watched for. As each event is completed, it is logged to the SW56 Events window. This log is displayed automatically when you click on **Start**, or can be viewed by clicking on **Switched 56 Events Display...**.

NOTE: If the expected event is not received within 60 seconds, a failure is declared, causing the sequence to timeout and terminate.

When a connection sequence is in progress, the transmit and receive data is dropped to the coder/decoder (CODEC). After the connection is made, an echo canceller disabler tone is transmitted for 2700 milliseconds. After this time, either BERT testing or protocol emulation (determined by the **Test Type** selection) is performed until the **Test Type** is changed or a new connection sequence is started.

The following paragraphs describe the available DDS (Switched 56) menu choices.

DS1 Channel — selects the DS1 channel for emulation. Choices are 1 to 24.

Supervision — shows the type of device the interface is emulating. Clicking on either of the choices or their respective boxes selects that type as the current supervision type. Choices are:

Terminating	Provides the ability to program a sequence of events sent by the device receiving the call.
Originating	Provides the ability to program a sequence of events sent by the device originating or placing the call.

The Supervision selection determines the Event choices available.

Event — shows the available event choices for the current supervision type. Up to 80 events can be added together to create a programmed sequence. Please refer to the Add switch description for information on how to create a connection sequence.

The Supervision selection determines the Event choices that are available. The following list is available when Supervision is set as indicated by the column heading:

Terminating:	**Originating:**
Transmit Terminating Wink	Receive Terminating Wink
Transmit Terminating Delay Dial	Receive Terminating Delay Dial
Transmit Terminating Off Hook	Receive Terminating On Hook
Receive Originating On Hook	Receive Terminating Off Hook
Receive Originating Off Hook	Transmit Originating Off Hook
Receive Dial Pulse Digits:	Transmit Originating Pause
Receive DTMF Digits:	Transmit Dial Pulse Digits:
	Transmit DTMF Digits:

The transmit events have the following transmitted characteristics:

Transmit Event:	Transmitted Characteristics:
Dial Pulse Digit	10 pps, 60% break value, 800 milliseconds between digits
DTMF Digit	70 milliseconds on, 70 milliseconds off
On-Hook	A=B=C=D=0
Off-Hook	A=B=C=D=1
Wink	On-hook for 50 to 1000 milliseconds, then off-hook for 30 to 600 milliseconds, and then on-hook again
Delay Dial	On-hook for 30 to 16000 milliseconds, then off-hook for 30 to 16000 milliseconds, and then on-hook again
Pause	Wait 1 second

NOTE: A 70-millisecond delay is inserted before the first dial pulse or DTMF digit, as well as before any on-hook or off-hook event.

The receive events must have the following received characteristics to be detected:

Receive Event:	Received Characteristics:
Dial Pulse Digit	7 to 21 pps, 40 to 68% break value, with >300 milliseconds between digits
DTMF Digit	≥40 milliseconds On, ≥40 milliseconds Off
On-Hook	Terminating: A=0, Originating: A=0 for > 100 milliseconds
Off-Hook	Terminating: A=1, Originating: A=1 for > 600 milliseconds
Wink	On-hook, then off-hook for 70 to 600 milliseconds, and then on-hook again
Delay Dial	On-hook, then off-hook for 70 to 16000 milliseconds, and then on-hook again

Delay and timing measurements are made for the following received terminating events:

Wink
Delay Dial
Off-Hook

Delay and timing measurements have the following characteristics:

Event:	Delay:	Duration:
Wink	0 to 16 seconds	70 to 600 milliseconds
Delay Dial	0 to 16 seconds	70 to 16000 milliseconds
Off-Hook	0 to 60 seconds	>600 milliseconds

Dial pulse digits — digits generated via a method of alternately opening and closing a contact through which DC current flows. There can be up to 80 digits in the pulse format.

DTMF digits — digits generated using set combinations of two specific voiceband frequencies. There can be up to 80 digits in the dual tone multifrequency (DTMF) format.

Off-hook — a signal indicating that a device is seizing the line.

On-hook — a signal indicating that a device is releasing the line (the idle condition).

Pause — a 1-second wait before the next sequence event is sent.

Wink — a temporary off-hook signal. The signaling goes from on-hook, to a temporary off-hook, and back to on-hook.

Delay dial — a temporary off-hook signal (an on-hook, off-hook, on-hook sequence) sent in response to indicate that the terminating end is ready to receive digits.

When **Supervision** is set to **Terminating**, and either Receive Dial Pulse Digits or Receive DTMF Digits is displayed in the **Content** box, and **Add** is clicked on, the Dial Pulse/DTMF Receive Digits dialog box (see Figure 6-5) is visible in the window. Enter the number of digits (1 to 80) for either pulse digits or DTMF digits that are expected to be received, then click on **OK** to add the selected content line to the connection sequence and return to the T1 Switched 56 (DDS) - Emulation Mode window.

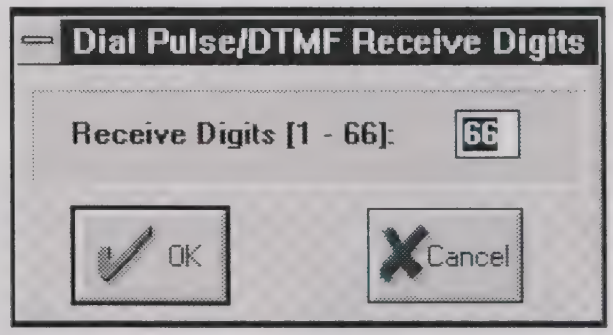

Figure 6-5
The Dial Pulse/DTMF Receive Digits Dialog Box

However, when **Supervision** is set to **Originating** and either Receive Dial Pulse Digits or Receive DTMF Digits is displayed, clicking on **Add** displays respectively either the Dial Pulse String dialog box or the DTMF String dialog box. Click on **OK** after you enter the number to be transmitted to return to the T1 Switched 56 (DDS) - Emulation Mode window. Click on **Cancel** to leave the number of digits as the last saved value, exit the dialog box, and return to the T1 Switched 56 (DDS) - Emulation Mode window.

Add — adds the displayed content line as the next connection sequence (up to 80 sequences can be specified). Each time **Add** is clicked on, the displayed content line is added to the connection sequence series.

Add can be used to insert an event in an existing connection sequence by performing the following steps:

1. Select the event to be added in the Event box.
2. Click on the **Connection Sequence** after which you want the event to be inserted.
3. Click on **Add**.

NOTE: Each digit transmitted is considered to be a separate sequence. For example, this means that if you transmit an 11-digit number for event number 4, the next sequence number is 15.

The content line is inserted into the Event box and the sequence numbers after the inserted content line are renumbered.

Remove — deletes the highlighted connection sequence from the displayed series and renumbers the remaining connection sequences. For example, clicking on **Remove** when connection sequence 15 is highlighted deletes what is currently listed for that connection sequence. Connection sequence 14 is then highlighted, what was connection sequence 16 becomes 15, and the total number decreases by 1. Each time **Remove** is clicked on, the same renumbering event occurs until no connection sequences are left.

Remove All — deletes all connection sequences at one time.

Edit — clicking on one of the Receive/Transmit DTMF Digits or Receive/Transmit Dial Pulse Digits sequences displays the Dial Pulse/DTMF Receive Digits dialog box (when **Supervision** is set to **Terminating**), which allows the number of receive digits (1 to 80) to be changed. However, when **Supervision** is set to **Originating** and either Receive/Transmit Dial Pulse Digits or Receive/Transmit DTMF Digits is displayed, clicking on **Edit** respectively displays either the Dial Pulse String dialog box or the DTMF String dialog box, which allows you to edit the displayed number string. **Edit** is grayed out unless Receive/Transmit DTMF Digits or Receive/Transmit Dial Pulse Digits is highlighted in the Event box.

Start — initiates the connection sequence, displays the SW56 Events window (see Figure 6-6), and displays each event as it occurs. Figure 6-6 shows an example of the SW56 Events window when **Supervision** is set to Terminating.

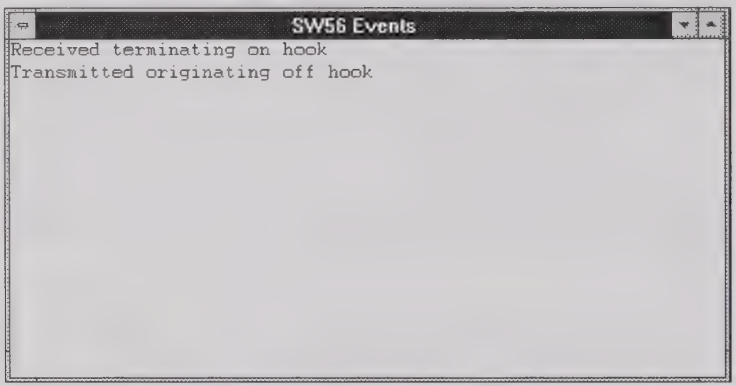

Figure 6-6
SW56 Events Window

Hang Up — performs the associated on-hook sequence for the supervision selection and terminates the connection.

Supervision Selection:	Hang Up:
Originating	Transmit Originating On Hook
Terminating	Transmit Terminating On Hook

Save — displays the Save As window when clicked for the first time, which allows you to enter a file name. If the file name is not valid, a dialog box appears indicating such. Click on **OK** in the dialog box and then type in a valid file name. After the file name is correct, click on **OK** to save the Connection Sequence in memory. Clicking again on **Save** overwrites the previous file stored in memory (with the same name) with the current Connection Sequence.

.trm — the default file extension when **Supervision** is set to **Terminating**
.org — the default file extension when **Supervision** is set to **Originating**

Save As — allows the current connection sequence to be saved in a file other than the one it is currently saved under. Clicking on **Save As** displays the Open window and allows you to specify the directory, path, and file name for the Connection Sequence to be saved.

Open — allows a previously saved file containing a connection sequence to be opened.

Transmitted Wink — provides control of the transmit wink parameters.

Delay	The delay time (50 to 1000 ms, in 10 ms increments) before wink transmission.
Duration	The length of time (30 to 600 ms, in 10 ms increments) a wink is transmitted.

Transmitted Delay Dial — provides control of the transmit delay dial parameters.

Delay	The delay time (30 to 16000 ms, in 10 ms increments) before delay dial transmission.
Duration	The length of time (30 to 16000 ms, in 10 ms increments) for delay dial transmission.

Help — allows context-sensitive help to be displayed for the T1 DDS (Switched 56) - Emulation Mode window for the selected function.

T1 Top Level — exits the T1DDS (Switched 56) - Emulation Mode window and redisplays the T1 Configuration - Top Level window.

5.5 DDS (DS0A/B)

This section describes the selection and configuration of the DS0A/B Analysis window.

5.5.1 DS0A/B Configuration

DDS (DS0A/B)... is available as a **T1 Mode** selection when **Test Type** is set to **T1 WAN Protocol**. With **DDS (DS0A/B)** selected, the **DDS (DS0A/B)...** key is visible at the bottom of the configuration window. Clicking on the **DDS (DS0A/B)...** key displays the DS0A/B Analysis window.

The DS0A/B Analysis window displayed is determined by the **Access** selection made on the T1 Configuration - Top Level window. Receive only, originate, and drop & insert are available as access selections. When **Access** is set to **Receive Only** and the **DDS (DS0A/B)...** key is pressed, the DS0A/B window shown in Figure 6-7 is displayed.

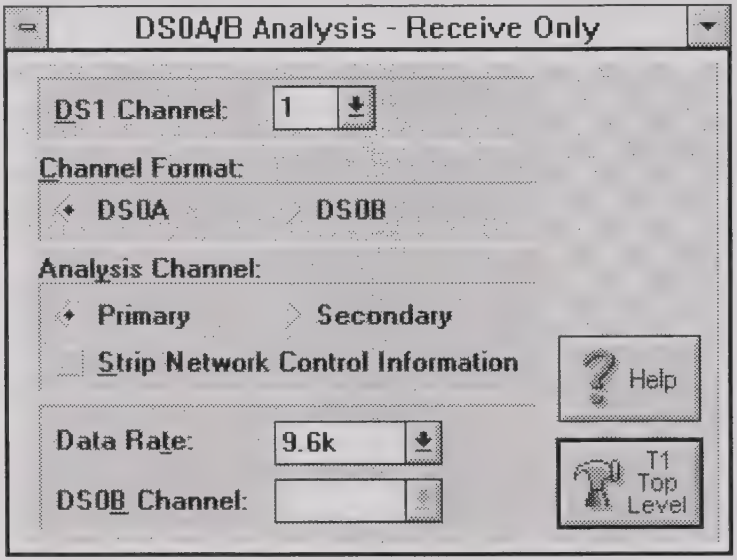

Figure 6-7
DS0A/B Receive Only Analysis Window

Configure the DS0A/B Analysis window to select the port, DS1 channel, and the channel format for analysis. Use the menu items visible on the window to configure either the DS0A or DS0B channel.

The following paragraph describes the available DS0A/B window menu choices.

DS1 Channel — Allows you to choose the DS1 channel for analysis. Choices are 1 to 24.

Click on the down arrow on this selection to see a list of the DS1 channel choices, then click on the scroller arrow box to view all of the channel choices. Click on the desired channel number to display it as the DS1 channel selection and close the drop-down box.

Channel Format — Shows the current channel format. Clicking on either the channel format or its box selects that format. Choices are DS0A and DS0B.

NOTE: With DS0B as the **Channel Format** selection, the **DS0B Channel** selection is no longer grayed out.

Analysis Channel — selects either the primary or secondary channel for analysis. Clicking on either Primary or Secondary or the associated box selects that channel.

Strip Network Control Information — shows whether network control information is stripped from the channel you want to analyze. Clicking on either the **Strip Network Control Information** label or its box toggles it to its opposite condition.

Data Rate — shows the data rate for the channel being analyzed. **Data Rate** choices are determined by the channel format selection, as follows:

DS0A:	DS0B:
2.4k	2.4k
4.8k	4.8k
9.6k	9.6k
19.2k	
38.4k	
56k	
64k	

DS0B Channel — allows you to select the DS0B channel for analysis. The number of channels available for **DS0B Channel** choices is determined by the **Data Rate** selection, as follows:

Data Rate:	DS0B Channels:
2.4k	1 - 20
4.8k	1 - 10
9.6k	1 - 5

The **DS0B Channel** selection is only available when **DS0B** is the **Channel Format** selection.

Help — allows context-sensitive help to be displayed for the selected function.

T1 Top Level — exits the DS0A/B Configuration window and redisplays the T1 Configuration - Top Level window.

6.6 FAD

This section describes the selection and configuration of the optional FAD (Facility Access Digroup) window.

6.6.1 FAD Configuration

With **Test Type** set to **T1 WAN Protocol**, and **T1 Mode** is set to **FAD**, the **FAD...** button is displayed near the bottom left corner of the configuration window. Clicking on the **FAD...** button displays the DS1 Channel Configuration window (see Figure 6-8), allowing you to:

- Set the data rate for either 56 or 64 kbps
- Select the base channel (1 to 24)
- Specify whether the channel selections are contiguous or non-contiguous
- Select the individual DS1 channel(s) to be received or transmitted for analysis

If Contiguous is selected, you can also specify the Base Channel (1-24) and the number of channels (up to 24).

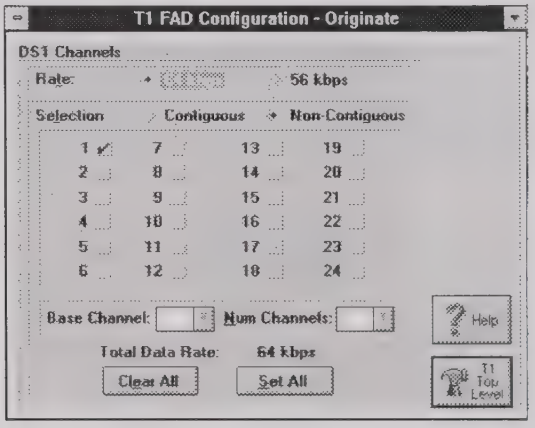

Figure 6-8
FAD DS1 Channels Configuration Window

Rate — selects the DS1 channel data rate (64 kbps or 56 kbps).

Selection — selects whether the selected DS1 channels are continuous or non-contiguous. Click on the Selection name or its box to enable that selection mode.

Contiguous

Allows you to specify a Base Channel (1-24) and Num Channels (up to 24) determined by the Base Channel selection.

The number of channels available is determined by the Base Channel selection. When the Base Channel selection is 1, the number of channels available are up to 24. As the Base Channel selection increments, the Num Channels available decrements. This is because the Num Channels cannot wrap back to 1. For example, setting the Base Channel selection to 20 results in the number of channels available being only 1 to 5.

Non-Contiguous

Allows you to specify any number of DS1 channels (1 to 24) regardless of their channel number. Clicking on a channel number box (1-24) toggles that selection to its opposite state. Clicking on an empty channel number box selects it and places a check mark in its box indicating that it is enabled and increments the Total Data Rate by either 56 kbps or 64 kbps. Clicking on a channel number box with a check mark in it removes the check mark indicating that the channel number is not selected and decrements the Total Data Rate by either 56 kbps or 64 kbps.

Any Contiguous channel selections are not cleared when Non-Contiguous is selected. However, all Non-Contiguous channels selected (except channel 1) are cleared when Contiguous is selected. Keep in mind that the unselected (inactive) channels are filled with the idle code (7F).

Base Channel: — selects the starting contiguous DS1 base channel. Click on the down arrow to display the base channel selections (1-24). This selection is only available when Selection is set to Contiguous.

Num Channels: — selects the number of contiguous DS1 channels (1-24) beginning with the Base Channel up to channel 24. Click on the down arrow to display the number of available channels. The number of channels available is determined by the Base Channel selection. As the Base Channel selection increments, the Num Channels available decrements. For example, if the Base Channel selection is 1, then the Num Channels available is from 1 to 24. However, setting the Base Channel selection to 17 displays 1 to 8 when the Num Channels down arrow is clicked on. The number of contiguous channels selected is not allowed to wrap around to channel 1. This selection is only available when Selection is set to Contiguous.

Total Data Rate: — displays the aggregate data rate for all enabled (selected) DS1 channels. Each time a DS1 channel is enabled or disabled, the value of Total Data Rate changes accordingly. The maximum value for Total Data Rate is determined by the selected data rate and the number of DS1 channels selected. Assuming all channels are selected for 64 kbps, the maximum data rate is 1536 kbps, or 1344 kbps for 56 kbps rate when all channels are selected.

Clear All — disables all selected Tx and Rx channels, clears all check marks, and sets the Total Transmit Rate and Total Receive Rate to 0 kbps.

Set All — enables all Tx and Rx channels, inserts a check mark next to all Tx and Rx channels, and also sets the Total Transmit Rate and Total Receive Rate to its maximum value for the selected data rate.

Help — allows context-sensitive help to be displayed for the T1 Configuration window for the selected function.

T1 Top Level — exits the Fractional T1 Configuration window and redisplays the T1 Configuration - Top Level window.

When **Access Type** (on the T1 Configuration - Top Level window) is set to **Receive Only**, both the Selected and Connected received data streams are available to the WAN Analyzer for monitoring over a single port. When **Access Type** (on the T1 Configuration - Top Level window) is set to **Originate**, both the Selected and Connected received data streams are available to the WAN Analyzer for emulation or traffic generation over separate ports.

6.7 TAD

This section describes the selection and configuration of the optional TAD (Test Access Digroup) window.

6.7.1 TAD Configuration

When **Test Type** is set to **T1 WAN Protocol**, **TAD...** is available as a T1 Mode selection. With TAD selected, the **TAD...** key is visible at the bottom of the configuration window. Clicking on the **TAD...** key displays the DS0 Channel window.

The T1 TAD Configuration window displayed is determined by the **Access** selection made on the T1 Configuration - Top Level window. **Receive Only**, **Originate**, and **Drop & Insert** are available as **Access** selections. When **Access** is set to **Receive Only** and the **TAD...** key is pressed, the DS0A/B window shown in Figure 6-9 is displayed.

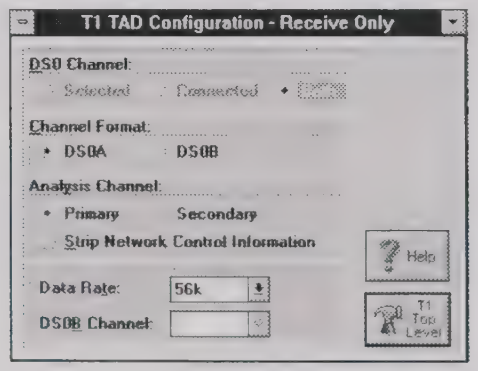

Figure 6-9
T1 TAD Configuration Receive Only Analysis Window

Use the menu items visible on the window to configure either the DS0A or DS0B channel. The following paragraphs describe the available T1 TAD Configuration window menu choices.

DS0 Channel — allows you to determine whether the DS0 channel status. The DS0 Channel selections are:

Selected	Allows you to indicate that the DS0 channel selections are for the selected channel (i.e., channel 1).
Connected	Allows you to indicate that the DS0 channel selections are for the connected channel (i.e., channel 2).
Both	Allows you to indicate that the DS0 channel selections are for both the selected and connected channel. This choice is only available when **Channel Format** is set to **DS0A** and **Analysis Channel** is set to **Primary**.

Note that when **Access** (on the T1 Configuration - Top Level window) is set to **Receive Only** the DS0 Channel selection is set to **Both**, the connected and selected receive data streams are made available to the WAN analyzer for monitoring over a single port.

Similarly, when **Access** (on the T1 Configuration - Top Level window) is set to **Originate**, the DS0 Channel selection (Connected or Selected) is made available to the WAN analyzer for emulation or traffic generation over a single port. However, when the DS0 Channel selection is **Both**, both the connected and selected sides are made available to the WAN analyzer for emulation or traffic generation over separate ports. Unselected DS0 channels transmit data is filled with the idle code (7F).

Channel Format — shows the current channel format. Clicking on either the channel format or its box selects that format. Clicking on the other channel format selects that as the channel format. Choices are:

DS0A	Selects the DS0A channel format and also allows you to specify the DS0A data rate.
DS0B	Selects the DS0B channel format and also allows you to specify the data rate and DS0B channel selection.

NOTE: With DS0B as the **Channel Format** selection, the **DS0B Channel** selection is no longer grayed out.

Analysis Channel — selects either the primary or secondary channel for analysis. Clicking on either Primary or Secondary or the associated box selects that channel for analysis.

NOTE: With DS0A as the **Channel Format** selection and **Data Rate** set to 64k, the **Secondary** Analysis Selection is grayed out and is not available for selection.

Strip Network Control Information — shows whether network control information is stripped from the channel you wish to analyze (a check mark in the box) or is not stripped from the channel (no check mark in the box). Clicking on either the **Strip Network Control Information** label or its box toggles it to its opposite condition.

Data Rate — shows the data rate for the channel being analyzed. **Data Rate** choices are determined by the channel format selection, as follows:

DS0A	DS0B
2.4k	2.4k
4.8k	4.8k
9.6k	9.6k
19.2k	
38.4k	
56k	
64k	

DS0B Channel — allows you to select the DS0B channel for analysis. The number of channels available for **DS0B Channel** choices is determined by the **Data Rate** selection, as follows:

Data Rate:	DS0B Channels:
2.4k	1 - 20
4.8k	1 - 10
9.6k	1 - 5

This selection is only available when **DS0B** is the **Channel Format** selection.

Help — allows context-sensitive help to be displayed for the selected function.

T1 Top Level — exits the T1 TAD Configuration window and redisplays the T1 Configuration - Top Level window.

SECTION 7
T1 ISDN PRI WAN PROTOCOL

7.1 SECTION OVERVIEW

This section describes the choices available when T1 ISDN WAN Protocol is the **Test Type** selection.

7.2 T1 ISDN PRI WAN PROTOCOL

Selecting **T1 ISDN PRI WAN Protocol** as the current **Test Type** displays the configuration window shown in Figure 7-1. This **Test Type** selection allows you to analyze the 64 kb/s D-channel while performing analysis on a B-channel.

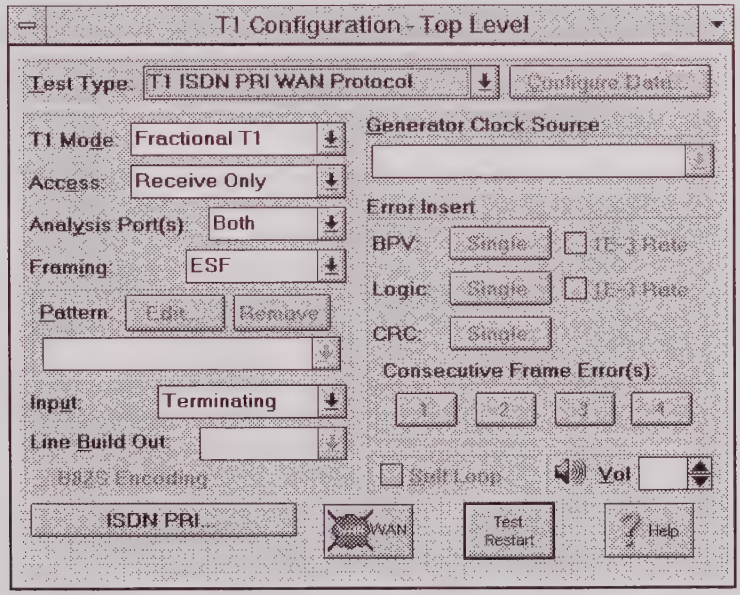

Figure 7-1
T1 ISDN PRI WAN Protocol Configuration Window

T1 Mode — selects the mode of T1 operation. The **T1 Mode** selection determines which additional selections are available at the bottom of the window. The only available choice is Fractional T1.

Access — selects the type of access used to conduct the test. Choices include:

Receive Only	Monitor only. Used for non-intrusive testing, and only allows analysis on received data (excluding BERT).
Originate	Transmit and receive. Used for inserting errors or patterns when transmitting and receiving data. Note that when **Access** is set to **Originate**, the B-and D-channel selections are made in the WAN application.

Analysis Port (s) — selects the port for the analysis and transmission of data. Choices are:

Line 1	Performs analysis on the port typically connected to the DCE (network) side. Line 1 should be connected to the DCE side.
Line 2	Performs analysis on the port typically connected to the DTE (CPE) side. Line 2 should be connected to the DTE side.
Both	Allows data to be received and transmitted on both ports simultaneously. Analysis of data on both ports is performed at the same time and is only available when **Access** is set to **Receive Only**. Results provided include: frame errors, CRC errors, receive frequency, etc.

Framing — selects the type of framing expected on the received signal and the format selected when transmitting. Choices are:

SF (D4)	Expects to receive T1 signals with D4 (Superframe) framing. SF framing occupies 8 kb/s of the 1.544 Mb/s bandwidth, with the data occupying the remaining 1.536 Mb/s. SF framing is compatible with D1D, D2, D3, and D4 channel banks.
ESF	Expects to receive T1 signals with Extended SuperFrame (ESF) framing format. ESF framing occupies 2 kb/s, CRC occupies 2 kb/s, and the data link occupies 4 kb/s, with the data occupying the remaining 1.536 Mb/s.

Pattern — is grayed out, since this selection is available for only BER tests.

Input — selects the input impedance for the unit. Choices are:

Terminating	Provides 100Ω input impedance to a properly terminated line. Accepts T1 signals between +6 dB and -35 dB (or -24 dB in the presence of jitter, as per PUB62411) and provides compensation for cable loss.
DSX Monitor	As with Terminating, provides 100Ω input impedance to a properly terminated line. Accepts T1 signals that have been resistively attenuated between 10 dB and 30 dB at the monitor jack.

Bridging Provides >1 kΩ input impedance to a properly terminated line.

Line Build Out — selects the line build-out signal reduction. Choices are:

0 dB Sets the transmit (Tx) output to the DSX level with no line build-out.

-7.5 dB Provides -7.5 dB line build-out, thus simulating 7.5 dB of attenuation due to cable loss.

-15 dB Provides -15 dB line build-out, thus simulating 15 dB of attenuation due to cable loss.

This selection is not available when **Access** is set to **Receive Only**.

B8ZS Encoding — indicates whether B8ZS encoding is used on transmitted data. Clicking on the box or label enables or disables B8ZS encoding.

Generator Clock Source — selects the timing source for the generator clock. Choices are:

Internal (1.544 MHz Fixed) Selects the internal oscillator as the generator clock source for transmit timing. The internal oscillator has a frequency accuracy of ±10 ppm.

External (BNC) Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω, and the signal must be a square wave from 1.5 V to 5.0 V peak-to-peak with a 0 V DC offset ±100 mV.

Recovered The generator clock is recovered from the received signal on the same line.

Recovered (Opposite) The generator clock source is recovered from the opposite T1 line. This selection is required for Drop & Insert.

Error Insert — allows errors to be entered at different error rates into the data stream. The following errors can be inserted into the data stream by clicking on the **Single** key or by clicking on the rate box, if available:

BPV (bipolar violation) Single or 1E-3. Clicking on **Single** inserts a single error into the data stream (by inverting the polarity of the 1 bit, causing a bipolar violation). Clicking on **1E-3** inserts 1 BPV error for every 1000 bits and places a check mark in the box.

CRC A single Cyclic Redundancy Check error is inserted each time **Single** is clicked on. CRC errors do not cause bit errors. CRC errors can only be inserted when **Framing** is set to **ESF**.

Consecutive Frame Error(s) — selects the number of adjacent frames that are errored. Choices are:

1	inserts a bit error in 1 frame in the transmitted data stream.
2	inserts a bit error in 2 consecutive frames in the transmitted data stream.
3	inserts a bit error in 3 consecutive frames in the transmitted data stream.
4	inserts a bit error in 4 consecutive frames in the transmitted data stream.

NOTE: Generating 2, 3, or 4 consecutive frame errors cause frame synchronization loss.

In addition to inserting errors on the T1 Configuration - Top Level window, error insert switch icons are included on the toolbar. These icon switches perform the same function as the corresponding **Single** switch. Clicking on the error switch icon inserts a single error of that type into the transmitted data stream. The error insert switch icons are grayed out if that error insert type is not allowed for the test being performed. Error insert switch icons include:

T1 Logic Err	inserts a single logic error in the transmitted data stream.
T1 CRC Err	inserts a single CRC error in the transmitted data stream.
T1 Frame Err	inserts a single frame error in the transmitted data stream.

These selection are grayed out when **Access** is set to **Receive Only**.

Self Loop — selects the self-loop mode. In this mode, you can test the transmitter and receiver circuits of the selected T1 interface before connecting the test instrument to a circuit. The self-loop mode allows the user to verify proper unit operation without disrupting any traffic on the line. Clicking once on **Self Loop** toggles it to its opposite condition (ON or OFF). This selection is not available when **Access** is set to **Receive Only**.

NOTE: When in self-loop mode, the use of "drop dead" relays allows T1 data to pass through when in the drop and insert configuration.

Help — allows context-sensitive help to be displayed for the current window.

WAN — activates the WAN Protocol Module.

Test Restart — clears all accumulated test results, starts accumulating results totals, and displays the Results window.

7.2.1 ISDN PRI...

The **ISDN PRI...** selection is only available when **Access** is set to **Receive Only**. Clicking on **ISDN PRI...** displays the ISDN PRI Configuration window (Figure 7-2). The ISDN PRI Configuration window displayed is determined by the **Access** selection. From the ISDN PRI Configuration window, you select the D-channel (1-24), the data rate (56 kbps or 64 kbps), and the Tx and Rx channel.

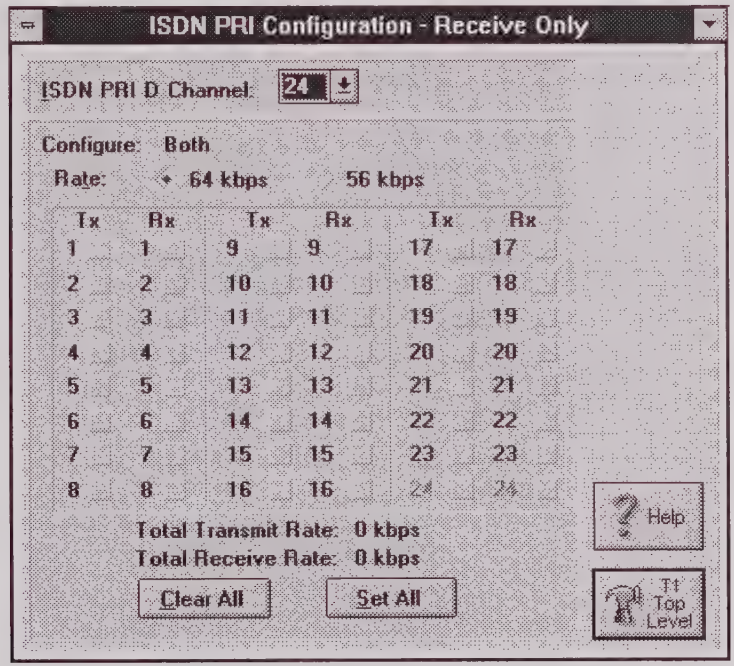
ISDN PRI Configuration - Receive Only
ISDN PRI D Channel:
24
Configure: Both
Rate: 64 kbps 56 kbps
Tx Rx Tx Rx Tx Rx
1 1 9 9 17 17
2 2 10 10 18 18
3 3 11 11 19 19
4 4 12 12 20 20
5 5 13 13 21 21
6 6 14 14 22 22
7 7 15 15 23 23
8 8 16 16 24 24
Total Transmit Rate: 0 kbps
Total Receive Rate: 0 kbps
Clear All
Set All
Help
T1 Top Level

Figure 7-2
ISDN PRI Configuration Window

ISDN PRI D Channel — shows the selected primary rate D-channel. ISDN PRI D Channel choices are 1 to 24.

Configure — indicates the current **Analysis Port(s)** selection. This selection (Both) was made on the T1 Configuration - Top Level window.

Rate — selects the ISDN primary B-channel data rate. Clicking on the diamond next to the data rate (64 kbps or 56 kbps), or clicking on the data rate itself selects that rate for all B-channels.

Tx/Rx — selects the individual B-channels that are received (i.e., enabled). Clicking on either the channel number or its box enables or disables the selected channel. When an individual B-channel is enabled, a check mark is visible in the box next to the channel selected. When a B-channel is enabled, the total receive rate increments to reflect the current B-channel configuration. Similarly, when a B-channel is no longer enabled, the receive total rate decreases to reflect the current B-channel configuration.

Total Receive Rate: — displays the aggregate data rate for all enabled (selected) Rx channels. Each time an Rx channel is enabled or disabled, the value of the Total Receive Rate changes correspondingly.

Clear All — disables all selected Rx channels. Clicking on this box clears all the check marks for each Tx and Rx channel and sets the Total Transmit Rate and Total Receive Rate to 0 kbps.

Set All — enables all Rx channels and inserts a check mark next to each one. It also sets the Total Receive Rate to its maximum value, which is 1472 kbps for 64 kbps and 1288 kbps for 56 kbps.

Help — allows context-sensitive help to be displayed for the selected function.

T1 Top Level — exits the ISDN PRI Configuration window and redisplays the T1 Configuration - Top Level window.

SECTION 8
DATA BERT

8.1 SECTION OVERVIEW

This section describes the choices available when Data BERT is the **Test Type** selection.

8.2 DATA BERT

Selecting **Data BERT** as the current **Test Type** displays a dialog box, indicating that you are about to perform an intrusive test. Clicking on **OK** displays the Data Configuration window (see Figure 8-1). This **Test Type** allows you to perform intrusive BER tests on data circuits.

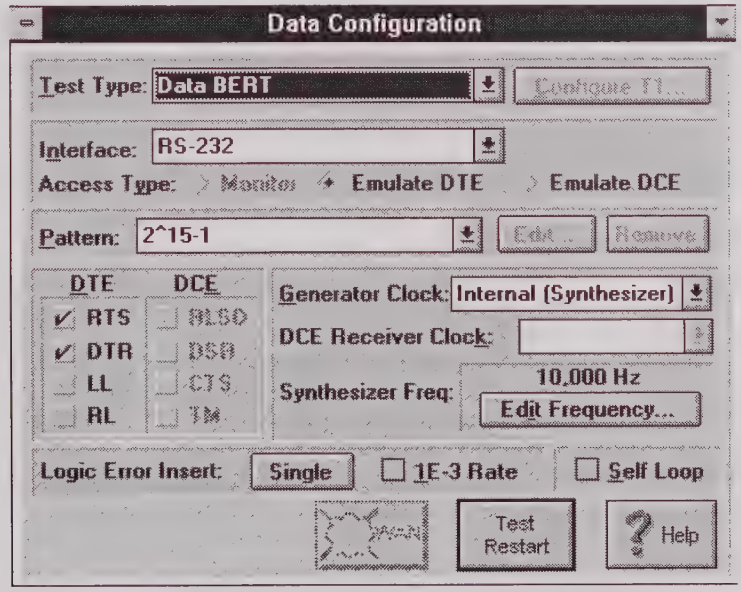

Figure 8-1
Data Configuration Window

The following choices are available, when **Test Type** is set to **Data BERT**.

Interface — selects the physical interface that connects the test module with the circuit to be tested. This selection determines the electrical characteristics and physical interface parameters for the physical connector being used. Interface choices are:

V.35
V.35 (306 Timing)
RS232
RS449 (RS423)
RS449 (RS422 Terminated)
RS449 (RS422 Unterminated)

The **Interface** selection determines the DTE/DCE signaling lead choices listed under DTE and DCE and the lead labels displayed in the Data Status window. The **Access Type** selection determines whether the DTE or DCE signaling lead choices are enabled.

Access Type — selects the type of access used when connecting to the circuit under test. Only one choice can be made at a time. Clicking on a selection (not grayed out) makes that choice current. Choices are:

Monitor	This selection is grayed out, since BERT is an intrusive test.
Emulate DTE	The test module emulates a DTE device. This is an intrusive test that allows you to emulate the customer premises side of the segment under test.
Emulate DCE	The test module emulates a DCE device. This is an intrusive test allowing you to emulate the network side of the segment under test.

If you change the **Access Type** from **Emulate DTE** to **Emulate DCE** or vice versa (for Data BERT), a dialog box is displayed informing you that you are about to perform an intrusive test. Click on **OK** to allow the intrusive test change, or click on **Cancel**.

Pattern — the pattern transmitted during the BERT. The **Pattern** selection is also the pattern that is expected when attempting to synchronize to the received data. **Pattern** choices are:

All-Ones (Mark)	A repeating pattern of all 1s.
All-Zeros (Space)	A repeating pattern of all 0s. Use this pattern instead of all 1s when you require an inverted data pattern.
1:1	A repeating pattern of a 1 followed by a 0. Use this pattern to perform a minimum-level stress test on clock recovery circuits.
63	A 63-bit (2^6-1) pseudorandom pattern with a maximum of 5 sequential 0s, and 6 sequential 1s. Provides the lowest stress of any pseudorandom pattern.

511 A 511-bit (2^9-1) pseudorandom pattern with a maximum of 8 sequential 0s and 9 sequential 1s. Compatible with DDS equipment, this pattern is recom-mended when testing at data rates below 9.6 kb/s.

2047 A 2047-bit (2^11-1) pseudorandom pattern with a maximum of 10 sequential 0s and 11 sequential 1s. Compatible with DDS equipment, this pattern is recommended when testing at data rates between 9.6 kb/s and 56 kb/s.

2^15-1 A 32,767-bit pseudorandom pattern with a maximum of 14 sequential 0s and 15 sequential 1s. Compatible with CCITT specifications for data rates of 64, 1544, 2048, 3152, and 6312 kb/s. Provides the maximum number of sequential 0s allowed in framed, non-B8ZS testing. This pattern is standard for G.703 testing.

2^20-1 A 1,048,575-bit pseudorandom pattern with a maximum of 19 sequential 0s and 20 sequential 1s. Recommended for data applications where excess zero transmission is required.

2^20-1R A reverse of the 2^20-1 pattern with 20 sequential 0s and 19 sequential 1s.

2^23-1 An 8,388,607-bit pseudorandom pattern with a maximum of 22 sequential 0s and 23 sequential 1s. The highest stress of all pseudorandom patterns.

2^23-1R A reverse of the 2^23-1 pattern with 22 sequential 1s and 23 sequential 0s.

QRSS A 1,048,575-bit (2^20-1) quasi-random signal source pattern that has been modified to transmit a maximum of 14 consecutive 0s. This pattern can be used to simulate live data.

New Bit Pattern... Displays the User Bit Pattern Editor window and allows you to name and then use the numeric keys (1 and 0) to enter a 3- to 24-bit pattern. Once the pattern is set as desired, click on **OK** and exit the User Bit Pattern Editor window. New patterns are added to the bottom of the pattern list and are preceded by **+>** to indicate that they have been added.

1:3 A repeating pattern of a 1 followed by three 0s.

1:7 A repeating pattern of a 1 followed by seven 0s.

2 in 8 A repeating pattern of two 1s in an 8-bit pattern. This pattern contains a maximum of 4 consecutive 0s.

3 in 24 — A repeating pattern of a 1 followed by three consecutive 0s (three times) followed by 15 consecutive 0s. This pattern provides the lowest 1s density (12.5%), as well as the maximum stress of the zero requirement for data circuits in a 24-bit pattern.

Edit... is grayed out until you enter a new bit pattern. With New **Bit Pattern...** chosen, clicking on **Edit...** displays the User Bit Pattern dialog box (see Figure 8-2).

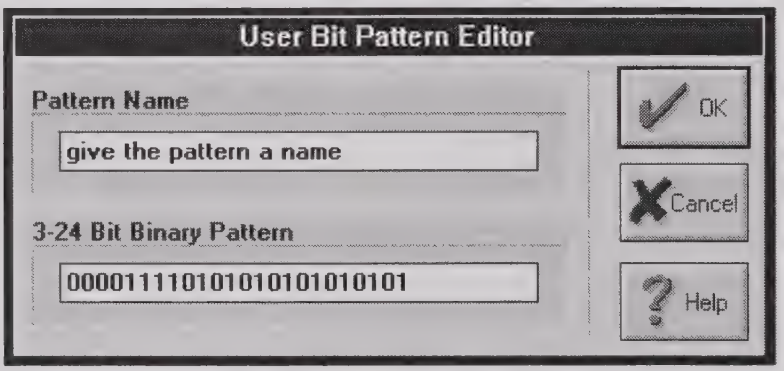

Figure 8-2
User Bit Pattern Dialog Box

Type in a name so you can recall the pattern for future use. Press the **Tab** key to move the cursor to the bit pattern box, then use the **1** and **0** keys to enter the bit pattern that you want. The pattern that you enter must contain at least 3 bits, or else it is considered invalid and is not allowed.

After a valid bit pattern has been entered, click on **OK** to save the new pattern. Bit patterns that you create are appended to the bottom of the pattern list and are preceded by **+>**.

Edit... also allows you to change a bit pattern that you have already created (a pattern preceded by **+>**). Note that you can change the bit pattern or the number of bits in the pattern, but you cannot change the pattern name.

To edit bit patterns that you have created, click on the pattern you want to change and then click on **Edit...** to display the User Bit Pattern dialog box with all the bits in the pattern highlighted. If you start entering a pattern, all the highlighted bits are deleted. If you want to only change one or two bits, click on the pattern at the place you want to change the existing pattern. You will notice that the Pattern Name box is grayed out, preventing you from changing the pattern's name. Click on **OK** to save the new changes under the old pattern name. Clicking on **Cancel** prevents any changes from taking place and redisplays the Data Configuration window.

Remove — deletes the highlighted pattern and pattern name that you created.

To delete bit patterns that you have created, click on the pattern name that you want to delete and then click on **Remove**.

DTE signaling lead group — emulates a DTE allowing you to control the signaling leads of the selected data interface setting them ON (a check mark) or OFF by clicking on the box or label. Clicking once on any DTE lead box or its label toggles the state of the signaling lead to its opposite condition. This selection is grayed out when **Access Type** is set to **Emulate DCE**.

The **Interface** selection (e.g., RS232, RS449, or V.35) determines the available DTE signaling leads. The following DTE lead choices are available for the listed **Interface** selection.

RS232/V.35	RS449
RTS - Request To Send	RS - Request To Send
DTR - Data Terminal Ready	TR - Terminal Ready
LL - Local Loopback	LL - Local Loopback
RL - Remote Loopback	RL - Remote Loopback

DCE signaling lead group — emulates a DCE and allows the signaling leads of the selected data interface to be set ON (a check mark) or OFF by clicking on the box or label. Clicking once on any DCE lead box or its label toggles the state of the signaling lead to its opposite condition. This selection is grayed out when **Access Type** is set to **Emulate DTE**. This selection is grayed out when **Access Type** is set to **Emulate DCE**.

The **Interface** selection (e.g., RS232, RS449, or V.35) determines the available DCE signaling leads. The following DCE lead choices are available for the listed **Interface** selection.

RS232/V.35	RS449
RLSD - Received Line Signal Detect	RR - Receiver Ready
DSR - Data Set Ready	DM - Data Mode
CTS - Clear To Send	CS - Clear To Send
TM - Test Mode	TM - Test Mode

NOTE: The lead state can be toggled by clicking on the spacebar when it is highlighted.

Generator Clock — selects the source of timing for the generator clock. Choices include:

Internal (Synthesizer)	Selects the internal frequency synthesizer as the transmit timing clock source. When selected as the generator clock source, the **Synthesizer Freq** can be changed by clicking on **Edit Frequency...**.

External (BNC) — Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω, and the signal must be a square wave from 1.5 V to 5.0 V peak-to-peak with a 0 V DC offset ±100 mV.

DCE Clock or **DTE Clock** — Selects the received DCE or DTE clock as the transmit timing clock source.

NOTE: When Access Type is set to DCE Emulation, DTE Clock is available as a Generator Clock Source selection; and when DTE Emulation is selected, DCE Clock is available as a selection.

DCE Receiver Clock — selects the receiver clock source. This selection is not available when **Access Type** is set to **Emulate DTE**. However, when **Access Type** is set to **Emulate DCE**, the DCE receiver clock source choices are:

Auto — Allows software to automatically select the DCE receiver clock source.

DCE Clock — Selects the DCE clock source for the DCE receiver.

DTE Clock — Selects the DTE clock source for the DCE receiver.

Synthesizer Freq — when Generator Clock is set to Internal (Synthesizer), the currently selected synthesizer frequency is displayed. Click on **Edit Frequency...** to display the Synthesizer Frequency Setup window (see Figure 8-3).

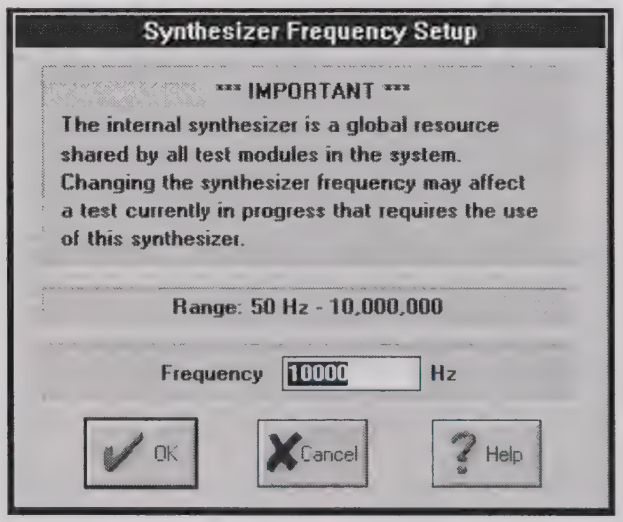
Synthesizer Frequency Setup
*** IMPORTANT ***
The internal synthesizer is a global resource shared by all test modules in the system. Changing the synthesizer frequency may affect a test currently in progress that requires the use of this synthesizer.
Range: 50 Hz - 10,000,000
Frequency
10000
Hz
OK
Cancel
Help

Figure 8-3
Synthesizer Frequency Setup Window

The frequency synthesizer range is from 50 Hz to 10 MHz (10,000,000 Hz), with 1 Hz resolution. After setting the synthesizer frequency, click on **OK** to confirm the set frequency or click on **Cancel** to return the synthesizer frequency to its previous value. Clicking on **OK** after changing the frequency displays the dialog box shown in Figure 8-4.

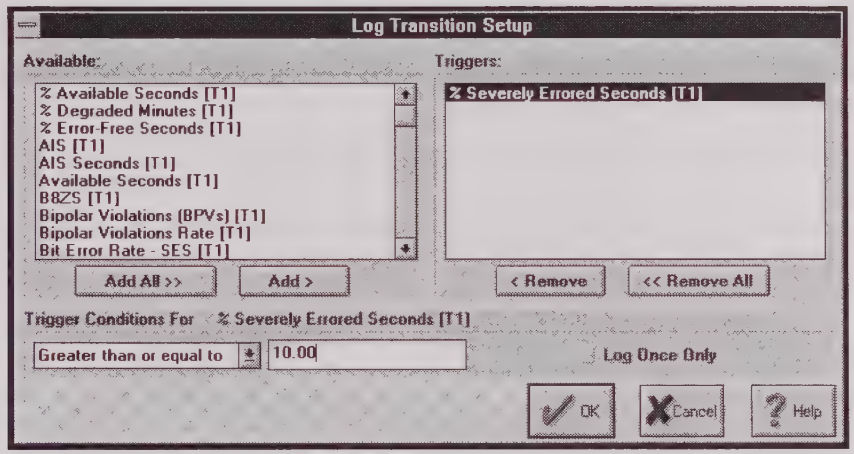

Figure 8-4
Restart all Test Modules Dialog Box

Clicking on **Yes** restarts all test modules and clears any accumulated results. Clicking on **No** allows the current results to continue accumulating.

NOTE: When performing data BERT, the interface selected and the cable length being used should be considered when setting the synthesizer frequency. Each data interface has a recommended maximum frequency (e.g., 50 Hz to 128 kHz for RS-232 and 50 Hz to 10 MHz for all other data interfaces).

This section is grayed out unless Generator Clock is set to Internal (Synthesizer).

Logic Error Insert — selects how many, if any, logic errors are inserted during the selected testing. Logic error insert choices are:

Single Inserts a single logic error each time this button is clicked on.

1E-3 Inserts a series of logic errors at a rate of 1 error every 1000 bits as long as the check mark is in the box next to **1E-3**. Clicking on the box or on **1E-3** toggles the logic error insertion on or off.

Self Loop — selects the self-loop mode, which tests the transmitter and receiver circuits of the selected data interface before connecting the test instrument to a circuit. The self-loop mode allows you to verify proper unit operation without disrupting traffic on the line. Clicking once on the **Self Loop** box or label toggles it on or off.

NOTE: When **Self Loop** is enabled, the test module is disconnected from the line under test.

Test Restart — clears all accumulated test results, starts accumulating results totals, and displays the Results window.

Help — allows on-line help to be displayed for the Data Configuration window.

SECTION 9
T1 BERT

9.1 SECTION OVERVIEW

This section describes the choices available when T1 BERT is the **Test Type** selection.

9.2 T1 BERT

Selecting **T1 BERT** as the current **Test Type** displays the configuration window shown in Figure 9-1. This **Test Type** selection allows you to perform physical layer Bit Error Rate Test (BERT) analysis on T1 circuits.

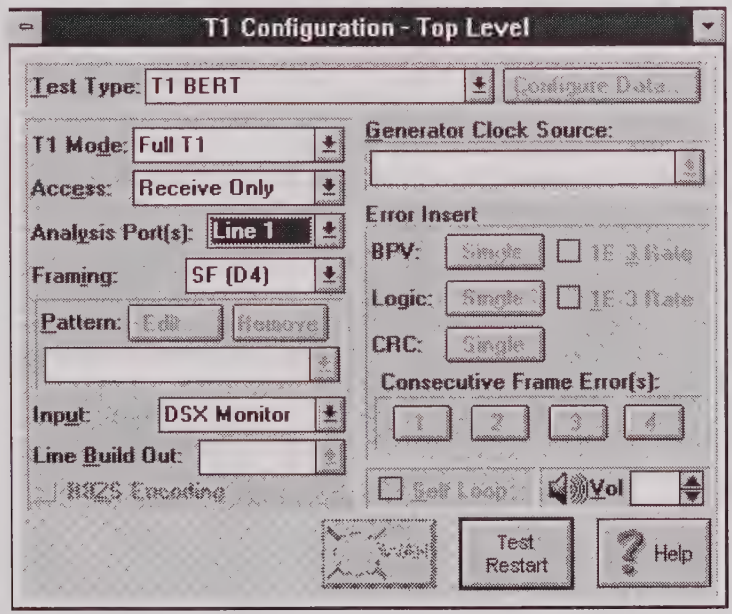

Figure 9-1
T1 BERT Configuration Window

Selections made on the T1 Configuration - Top Level window determine what choices are available and the ability to choose submenu items. For example, if you have selected **T1 BERT** as the **Test Type**, and **Access** is set to **Receive Only**, you cannot select a pattern or insert an error—this is because you are only monitoring. By setting **Access** to **Originate**, you can select a pattern or insert an error. Table 9-1 lists possible combinations for selections on the T1 Configuration - Top Level window when **Test Type** is set to **T1 BERT**.

Table 9-1
T1 Configuration - Top Level Window Choices

T1 Mode:	Full T1:		Fractional T1:			Switched 56:		
Access Type	R O	Org	R O	Org	D&I	R O	Org	D&I
Analysis Ports	B/2/1	2/1	B/2/1	2/1	2/1	B	2/1	2/1
Framing	U/E/S	U/E/S	S/E	S/E	S/E	S/E	S/E	S/E
Pattern	N/A	Avail	N/A	Avail	Avail	N/A	Avail	Avail
Input	T/M/B	T/M/B	T/M/B	T/M/B	T/M/B	T/M/B	T/M/B	T/M/B
Line Build Out	N/A	Avail	N/A	Avail	Avail	N/A	Avail	Avail
Transmit B8ZS	N/A	Avail	N/A	Avail	Avail	N/A	Avail	Avail
Gen Clk Srce	N/A	Avail	N/A	Avail	ROR	N/A	Avail	ROR
Error Insert	N/A	Avail	N/A	Avail	Avail	N/A	Avail	Avail
Self Loop	N/A	Avail	N/A	Avail	Avail	N/A	Avail	Avail
			Fractional T1...			DDS (SW 56)...		

Legend

Access	Analysis	Framing	Input	Gen Clk Source
R O - Receive Only	B - Both	U - Unframed	T - Terminating	ROR - Recovered Opposite Receiver
Org - Originate	2 - Line 2	E - ESF	M - DSX Monitor	Avail - Available
D&I - Drop and Insert	1 - Line 1	S - SF (D4)	B - Bridge	

When you select T1 BERT as the **Test Type**, you will see the dialog box displayed in Figure 9-2.

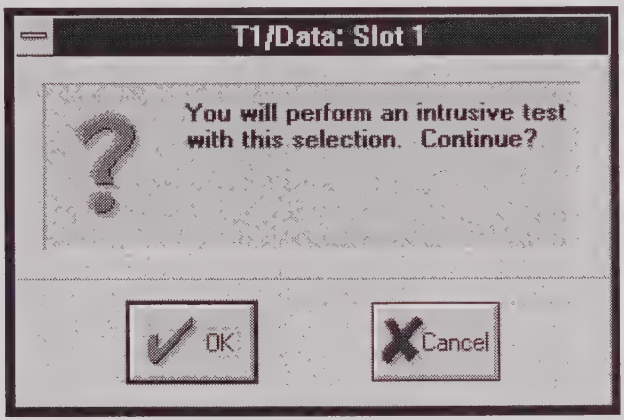

Figure 9-2
Intrusive Test Dialog Box

This dialog box indicates that the test you are going to initiate is an intrusive test. Click on **Cancel** to cancel the T1 BERT test or click on **OK** to proceed with the window display.

NOTE: The intrusive warning dialog box can be turned off by clicking on **Options** to display the choices. Clicking on **Intrusive Warning** removes the check mark and prevents the intrusive warning dialog box from being displayed when an intrusive test it going to be performed.

T1 Mode — selects the mode of T1 operation. The **T1 Mode** selection determines which additional selections are available at the bottom of the window. The following is a list of **T1 Mode** choices:

Full T1	No other window available
Fractional T1	Fractional T1 window available
DDS (SW 56)	DDS (Switched 56)... window available

Access — selects the type of access used to conduct the test. Choices include:

Receive Only	Monitor only. Used for non-intrusive testing, and only allows analysis on received data (excluding BERT).
Originate	Transmit and receive. Used for intrusive testing when transmitting and receiving data.

Drop & Insert — Receive and transmit. Used for in-service testing when one or more channels are to be dropped for analysis, while the unselected channels pass through. This selection is not available when **T1 Mode** is set to **Full T1**.

Analysis Port (s) — selects the port for analysis and transmission of data on. Choices are:

Both — Allows data to be received, transmitted, and analyzed on both ports simultaneously. Results provided include frame errors, CRC, Rx freq, etc. Note, however that BERT analysis is not performed.

Line 1 — Performs analysis on the port typically connected to the DCE (network) side. Line 1 should typically be connected to the DCE side.

Line 2 — Performs analysis on the port typically connected to the DTE (CPE) side. Line 2 should typically be connected to the DTE side.

Framing — selects the type of framing expected on the received signal and the format selected when transmitting. Choices are:

Unframed — Expects to receive unframed data. Since no framing bits are expected, no data bits are stripped from the received data. This selection is only available when **T1 Mode** is set to **Full T1**.

SF (D4) — Expects to receive T1 signals with D4 (Superframe) framing. SF framing occupies 8 kb of the 1.544 Mb/s bandwidth, with the data occupying the remaining 1.536 Mb/s. SF framing is compatible with D1D, D2, D3, and D4 channel banks.

ESF — Expects to receive T1 signals with Extended SuperFrame (ESF) framing format. ESF framing occupies 2 kb/s, CRC occupies 2 kb/s, and the data link occupies 4 kb/s, with the data occupying the remaining 1.536 Mb/s.

Pattern — selects the test pattern for BERT use only. **Pattern** choices are:

All-Ones (Mark) — A repeating pattern of all 1s. Equivalent to the red alarm signal when unframed. Provides maximum power level for T1 signal.

All-Zeros (Space) — A repeating pattern of all 0s. Use this pattern instead of All-Ones when you require an inverted data pattern.

1:1 — A repeating pattern of a 1 followed by a 0. Use this pattern to perform a minimum-level stress test on clock recovery circuits.

63 A 63-bit (2^6-1) pseudorandom pattern with a maximum of 5 sequential 0s, and 6 sequential 1s. Provides the lowest stress of any pseudorandom pattern.

511 A 511-bit (2^9-1) pseudorandom pattern with a maximum of 8 sequential 0s and 9 sequential 1s. Compatible with DDS equipment, this pattern is recommended when testing at data rates below 9.6 kb/s.

2047 A 2047-bit (2^11-1) pseudorandom pattern with a maximum of 10 sequential 0s and 11 sequential 1s. Compatible with DDS equipment, this pattern is recommended when testing at data rates between 9.6 kb/s and 56 kb/s.

2^15-1 A 32,767-bit pseudorandom pattern with a maximum of 14 sequential 0s and 15 sequential 1s. Compatible with CCITT specifications for data rates of 64, 1544, 2048, 3152, and 6312 kb/s. Provides the maximum number of sequential 0s allowed in framed, non-B8ZS testing. This pattern is standard for G.703 testing.

2^20-1 A 1,048,575-bit pseudorandom pattern with a maximum of 19 sequential 0s and 20 sequential 1s. Recommended for T1 applications where excess zero transmission is required.

2^20-1R A reverse of the 2^20-1 pattern with 20 sequential 0s and 19 sequential 1s.

2^23-1 An 8,388,607-bit pseudorandom pattern with a maximum of 22 sequential 0s and 23 sequential 1s. The highest stress of all pseudorandom patterns.

2^23-1R A reverse of the 2^23-1 pattern with 22 sequential 1s and 23 sequential 0s.

QRSS A 1,048,575-bit (2^20-1) quasi-random signal source pattern that has been modified to transmit a maximum of 14 consecutive 0s. This is the standard pattern for T1 testing and can be used to simulate live data.

New Bit Pattern...

Displays the User Bit Pattern Editor window, which allows you to name and create a 3- to 24-bit pattern using the numeric keys (1 and 0) to enter. Click on the 3-24 Bit Binary Pattern box, then use the 1 and 0 keys to enter the desired bit pattern. Once the pattern is set, click on **OK** and exit the User Bit Pattern Editor window. New patterns are added to the bottom of the pattern list and are preceded by **+>**. This pattern is frame-aligned so as not to cause RAI (Remote Alarm Indication) (Yellow Alarm) to be generated in SF (D4) framing.

1:3

A repeating pattern of a single 1 followed by three 0s. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.

1:7

A repeating pattern of a single 1 followed by seven 0s. The maximum stress of the one's density (12.5%) requirements for T1 circuits. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.

2 in 8

A repeating pattern of two 1s in an 8-bit pattern. This pattern contains a maximum of 4 consecutive 0s. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.

3 in 24

A repeating pattern of a single 1 followed by three consecutive 0s (three times) followed by 15 consecutive 0s. This pattern provides the lowest one's density (12.5%), and provides the maximum stress of the zero requirement for T1 circuits in a 24-bit pattern. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.

T1-1 (Min-Max)

A fixed 72-octet hexadecimal pattern used for stress testing the repeater preamplifier and Automatic Line Build-Out (ALBO) circuitry. Use this pattern to detect marginal equipment using rapid transitions from low 1s density to high 1s density.

T1-2 (Trip-Test)

A fixed 96-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.

T1-3

A fixed 54-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.

T1-4

A fixed 120-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.

T1-5	A fixed 53-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
T1-6	A fixed 55-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
T1-Milliwatt	A fixed pattern of 247 bytes simulating a digitized 1004 Hz tone with a 0 dBm0 level on one DS-0 channel. Provides a standard tone for voice testing.
T1-Daly	A fixed 72-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
DDS-1	A fixed pattern of 100 octets of all ones (1111 1111) followed by 100 octets of all zeros (0000 0000).
DDS-2	A fixed pattern of 100 octets of 0111 1110 followed by 100 octets of all zeros (0000 0000).
DDS-3	A fixed pattern of 0100 1100.
DDS-4	A fixed pattern of 0000 0010.
DDS-5	A fixed pattern consisting of DDS patterns 1 through 4.
DDS-6	A fixed pattern of 7 octets of 1111 1110 followed by 1 octet of 1111 1111.

Edit... — allows you to change a bit pattern that you have created (a pattern preceded by **+>**). To change a pattern, highlight the pattern name to be edited, then click on **Edit...** to change the displayed pattern. You can change the bit pattern or the number of bits in the pattern, but you cannot change the pattern name.

If you immediately change a pattern while editing, all highlighted bits are deleted. If you want to change only one or two bits, click on the pattern at the place you want to change the existing pattern. The Pattern Name box is grayed out, preventing you from changing the pattern's name. Click on **OK** to save the new changes under the old pattern name. Click on **Cancel** to prevent any changes from taking place and redisplay the T1 Configuration - Top Level window.

Remove — deletes the highlighted pattern and pattern name that you created. Patterns can be deleted by clicking on the pattern name that you want to delete and then clicking on **Remove**.

Input — selects the input impedance for the unit. Choices are:

Terminating	Provides 100Ω input impedance to a properly terminated line. Accepts T1 signals between +6 dB and -35 dB (or -24 dB in the presence of jitter, as per PUB62411) and provides compensation for cable loss.
DSX Monitor	Like terminating, provides 100Ω input impedance to a properly terminated line. Accepts T1 signals that have been resistively attenuated between 10 dB and 30 dB at the monitor jack.
Bridging	Provides >1 kΩ input impedance to a properly terminated line.

Line Build Out — selects the line build-out signal reduction. Choices are:

0 dB	Sets the transmit (Tx) output to the DSX level with no line build-out.
-7.5 dB	Provides -7.5 dB line build-out, thus simulating 7.5 dB of attenuation due to cable loss.
-15 dB	Provides -15 dB line build-out, thus simulating 15 dB of attenuation due to cable loss.

This selection is not available when **Access** is set to **Receive Only**.

B8ZS Encoding — selects whether B8ZS encoding is used on transmitted data. Clicking on the box or label toggles the B8ZS encoding selection to its opposite condition (e.g., on to off). This selection is not available when **Access** is set to **Receive Only**.

Generator Clock — selects the timing source for the generator clock. Choices are:

Internal (1.544 MHz Fixed)	Selects the internal oscillator as the generator clock source for transmit timing. The internal oscillator has a frequency accuracy of ±10 ppm.
External (BNC)	Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω and the must be a square wave, from 1.5 V to 5.0 V peak-to-peak, with a 0 V DC offset ±100 mV.
Recovered	The generator clock is recovered from the received signal on the same line.
Recovered (Opposite)	The generator clock source is recovered from the opposite T1 line. This selection is required for Drop & Insert.

This selection is not available when **Access** is set to **Receive Only**.

Error Insert — allows the insertion of different errors into the data stream at a given error rate. The following errors can be inserted into the data stream by clicking on the **Single** key or by clicking on the rate box, if available:

BPV (bipolar violation)	Single or 1E-3. A single bit error is inserted into the data stream each time you click on **Single** (by inverting the polarity of the 1 bit). **1E-3** inserts a series of logic errors at a rate of 1 error every 1000 bits as long as the check mark is in the box next to 1E-3. Clicking on 1E-3 toggles the activity on or off.
Logic	Single or 1E-3. A single logic error is inserted into the data stream each time you click on **Single**. **1E-3** inserts a series of logic errors at a rate of 1 error every 1000 bits as long as the check mark is in the box next to **1E-3**. Clicking on **1E-3** toggles the activity on or off. This selection does not cause CRC errors for ESF.
CRC	Single. A single CRC error is inserted each time you click on **Single**. A single Cyclic Redundancy Check error can only be inserted when **Framing** is set to **ESF**. CRC errors do not cause bit errors.

This selection is grayed out when **Access** is set to **Receive Only**.

Consecutive Frame Error(s) — selects the number of adjacent frames that are errored. Choices are:

1	inserts a bit error in 1 frame in the transmitted data stream.
2	inserts a bit error in 2 consecutive frames in the transmitted data stream.
3	inserts a bit error in 3 consecutive frames in the transmitted data stream.
4	inserts a bit error in 4 consecutive frames in the transmitted data stream.

NOTE: Generating 2, 3, or 4 consecutive frame errors cause frame synchronization loss when in self-loop mode.

In addition to inserting errors on the T1 Configuration - Top Level window, error insert switches are included on the toolbar. Clicking on the error switch inserts a single error of that type into the transmitted data stream. The error insert switches are grayed out if that error insert type is not allowed for the test being performed. Error insert switches include:

T1 Logic Err	inserts a single logic error in the transmitted data stream.
T1 BPV Err	inserts a single bipolar violation error in the transmitted data stream.

T1 CRC Err — inserts a single CRC error in the transmitted data stream.

T1 Frame Err — inserts a single frame error in the transmitted data stream.

Self Loop — selects the self-loop mode, which tests the transmitter and receiver circuits of the selected data interface before connecting the test instrument to a circuit. The self-loop mode allows you to verify proper unit operation without disrupting traffic on the line. Clicking once on **Self Loop** toggles it on or off. This selection is not available when **Access** is set to **Receive Only**.

NOTE: When in self-loop, the use of "drop dead" relays allows T1 data to pass through when in the drop and insert configuration.

9.3 FRACTIONAL T1

With T1 Mode set to **Fractional T1**, the **Fractional T1...** button is displayed near the bottom left corner of the configuration window. Clicking on the **Fractional T1...** button displays the Fractional T1 Configuration window (see Figure 9-3), allowing you to:

- Configure the data rate for either 56 or 64 kbps
- Select either Line 1 or Line 2
- Select the DS1 channel(s) to be individually selected to receive or transmit

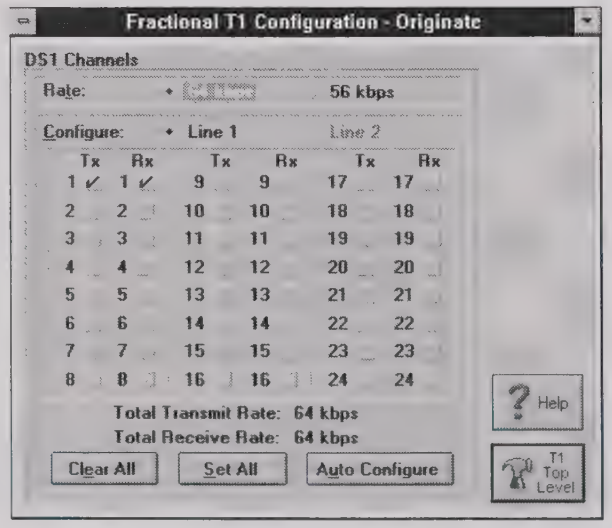

Figure 9-3
Fractional Configuration Window

Rate — selects the DS1 channel data rate (64 kbps or 56 kbps).

Configure — shows the **Analysis Port(s)** selection (Line 1 or Line 2), on the T1 Configuration - Top Level window, for which the DS1 channels are configured. When set to **Both**, you can use the radio buttons to select which line configuration is displayed for modification. The way the DS1 channel configuration functions is determined by the T1 Configuration - Top Level window settings. For example, when **Access** is set to **Originate**, configuring the Tx and Rx channels allows data to be inserted for the selected line as shown for each channel.

However, if **Access** is set to **Drop & Insert**, data is dropped from, and inserted into, the selected analysis port as configured (Tx = insert, Rx = drop); when no Tx boxes have a check mark in them, data is passing through the T1 test module: Line 1 Rx to Line 2 Tx, Line 2 Rx to Line 1 Tx. Selecting Tx channels overwrites the selected channels at the analysis port with data from the WAN card. For the non-analysis port, these same channels are overwritten with the idle code. The dropped channels are overwritten on their Tx channels with the idle code (01111111) on the other line, while allowing unselected channels to pass through unaffected, and prevent loop codes or other test patterns from being transmitted over the network. Thus, when you configure the selected line, the other line is automatically configured to keep data on the dropped/inserted channels from being sent across the network.

Tx/Rx — selects the individual DS1 channels and determines whether transmit (Tx), receive (Rx), or both, are enabled. Clicking on either the channel number or its box toggles the selected channel to its opposite condition.

Total Transmit Rate: — displays the aggregate data rate for all enabled (selected) Tx channels. Each time a DS1 Tx channel is enabled or disabled, the value of Total Transmit Rate changes accordingly. The maximum value for Total Transmit Rate is determined by the selected data rate and the number of transmit (Tx) channels selected. Assuming all channels are selected for 64 kbps rate, the maximum rate is 1536 kbps, or 1344 kbps for 56 kbps rate when all channels are selected.

Total Receive Rate: — displays the aggregate data rate for all enabled (selected) Rx channels. Each time a DS1 Rx channel is enabled or disabled, the value of Total Receive Rate changes accordingly. The maximum value for Total Receive Rate is determined by the selected data rate and the number of receive (Rx) channels selected. Assuming all channels selected for 64 kbps rate, the maximum rate is 1536 kbps, or 1344 kbps for 56 kbps rate when all channels are selected.

Clear All — disables all selected Tx and Rx channels, clears all check marks, and sets the Total Transmit Rate and Total Receive Rate to 0 kbps.

Set All — enables all Tx and Rx channels, inserts a check mark next to all Tx and Rx channels, and also sets the Total Transmit Rate and Total Receive Rate to its maximum value for the selected data rate. When **Access** is set to **Receive Only** the Rx channels are set, but none of the Tx channels are set.

Auto Configure — Determines which channels are currently active and automatically configures the channels accordingly. The test module scans all channels looking for the idle code for that data rate; if the test module can be synchronized with the idle code, it indicates that the currently scanned channel is idle. Channels that the test module cannot synchronize to are considered to be active and are configured for transmit and receive. When **Auto Configure** is clicked on the message:

Please wait...scanning for active channels...

is displayed while the active channels are scanned. A channel is considered to be inactive if the following idle code is detected in the monitored channel.

Data Rate:	Idle Code:
64 kbps	01111111
56 kbps	0111111X (bit 8, or the least significant bit is the "Don't Care" bit)

NOTE: This selection is only available when **Access** is set to **Originate**.

Help — allows context-sensitive help to be displayed for the selected function.

T1 Top Level — exits the Fractional T1 Configuration window and redisplays the T1 Configuration - Top Level window.

9.4 DDS (SW 56)

When **T1 Mode** is set to **DDS (SW56)**, the **DDS (SW56)...** button is visible near the bottom left corner of the configuration window. Clicking on **DDS (SW56)...** displays the T1 Switched 56 (DDS) window.

DDS Switched 56 operates as a monitoring device or as an emulating device. The following sections describe the different switched 56 windows and modes of operation.

9.4.1 Monitor Mode

Monitor mode is selected when **Test Type** is set to **T1 BERT**, **T1 Mode** is set to **DDS (SW 56)**, and **Access** is set to **Receive Only**. Clicking on **DDS (SW-56)...** displays the T1 Switched 56 (DDS) - Receive Only window (see Figure 9-4).

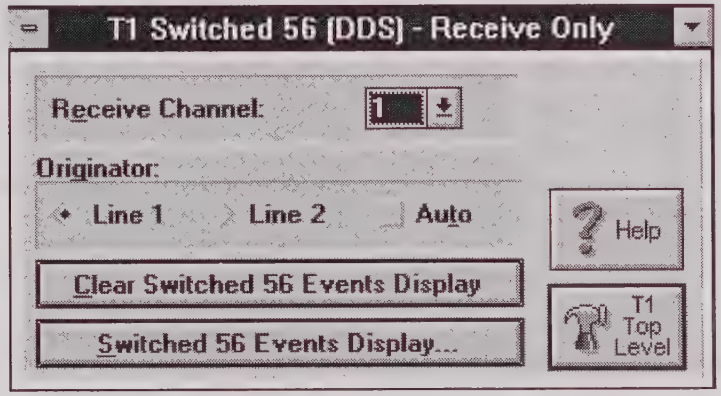

Figure 9-4
T1 Switched 56 (DDS) - Receive Only Window

In receive-only mode, you can select the channel and the originating line, or allow the monitored line to be selected automatically. The only other choices are to view the Switched 56 events, or to clear the events on the SW56 Events display.

Receive Channel: — shows the selected receive channel that is being monitored for events. Choices are 1 to 24.

Originator — selects the direction monitored for originating events and digits. Choices are:

Line 1	Monitored for originating events and digits; Line 2 is monitored for terminating events.
Line 2	Monitored for originating events and digits; Line 1 is monitored for terminating events.
Auto	Whichever line goes off-hook first is labeled the originator.

Switched 56 Events Display — restores and displays the SW56 Events window. The SW56 Events display provides you with a log of the events that occurred since the log was last cleared.

Clear Switched 56 Events Display — deletes the events logged to the SW56 Events Display. The SW56 Events window is a log of the SW56 events that have occurred. If you want to start a new log, clear the SW56 Events display by clicking on this selection.

Help — allows context-sensitive help to be displayed for the selected function.

T1 Top Level — exits the T1 Switched 56 (DDS) - Receive Only window and redisplays the T1 Configuration - Top Level window.

9.4.2 Emulation Mode

In emulation mode, you can configure the interface as either an originating or terminating device and establish the connection sequence. When emulating an originating device, you can generate a sequence of transmit and receive events to initiate a dialed-up connection. When emulating a terminating device, you can generate a sequence of transmit and receive events designed to accept an incoming call.

Emulation mode is selected when **T1 Mode** is set to **DDS (SW 56)** and **Access** is set to **Originate** or to **Drop & Insert**. Clicking on **DDS (SW 56)...** displays the T1 Switched 56 (DDS) - Emulation Mode window.

The type of emulation (Originate or Drop & Insert) is determined by the **Access** selection. With **Access** set to **Drop & Insert**, a dialog box is displayed informing you that you are about to perform an intrusive test. Click on **OK** to redisplay the T1 Configuration - Top Level window. Click on **DDS (SW 56)...** to display the T1 Switched 56 (DDS) - [Emulation] - Drop & Insert window (see Figure 9-5).

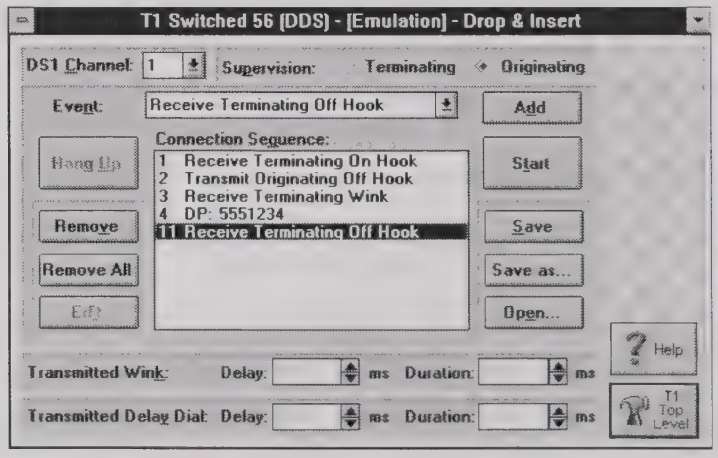

Figure 9-5
T1 Switched 56 (DDS) - Drop & Insert Emulation Mode Window

With this window displayed, you can specify the DS1 channel and the type of supervision, and then either enter a series of events, or recall a previously saved sequence of events. The **Start**, **Hang Up**, **Remove**, **Remove All**, **Edit**, **Save**, and **Save as...** keys are grayed out until you add an event to the Connection Sequence box. Once an event has been added, all the keys are available (except for **Hang Up** and **Edit**).

To add an event to the Connection Sequence box, do the following:

1. Click on the down arrow for Event to see the choice of events for the selected Supervision (Terminating or Originating).
2. Highlight the desired event.
3. Click on **Add** to add that event to the sequence of events.
4. Click on **Start**, to initiate the sequence of events that you entered and display the SW56 Events window, showing you the event sequence status.

When you click on **Start**, an on-hook is transmitted for 2 seconds to clear the line (only when the Supervision selection is Originating). After the on-hook is transmitted, the event sequence is stepped through.

The transmit events are generated and receive events are watched for. As each event is completed, it is logged to the SW56 Events window. This log is displayed automatically when you click on **Start**, or can be viewed by clicking on **Switched 56 Events Display...**.

NOTE: If the expected event is not received within 60 seconds, a failure is declared, causing the sequence to timeout and terminate.

When a connection sequence is in progress, the transmit and receive data is dropped to the coder/decoder (CODEC). After the connection is made, an echo canceller disabler tone is transmitted for 2700 milliseconds. After this time, either BER testing is performed until the **Test Type** is changed or a new connection sequence is started.

DS1 Channel — selects the DS1 channel for emulation. Choices are 1 to 24.

Supervision — shows the type of device the interface is emulating. Clicking on either choice or its respective box selects that type. Choices are:

Terminating	Provides the ability to program a sequence of events sent by the device receiving the call.
Originating	Provides the ability to program a sequence of events sent by the device originating or placing the call.

The Supervision selection determines the **Event** choices available.

Event — shows the available event choices for the current supervision type selection. Up to 80 events can be added together to create a programmed sequence. Please refer to the Add switch description for information on how to create a connection sequence.

The **Supervision** selection determines the event choices that are available. The following list is available when **Supervision** is set as indicated.

Terminating:	**Originating:**
Transmit Terminating Wink	Receive Terminating Wink
Transmit Terminating Delay Dial	Receive Terminating Delay Dial
Transmit Terminating Off Hook	Receive Terminating On Hook
Receive Originating On Hook	Receive Terminating Off Hook
Receive Originating Off Hook	Transmit Originating Off Hook
Receive Dial Pulse Digits:	Transmit Originating Pause
Receive DTMF Digits:	Transmit Dial Pulse Digits:
	Transmit DTMF Digits:

The transmitted events have the following characteristics:

Event:	**Transmitted Characteristics:**
Dial Pulse Digit	10 pps, 60% break value, 800 milliseconds between digits
DTMF Digit	70 milliseconds on, 70 milliseconds off
On-Hook	A=B=C=D=0
Off-Hook	A=B=C=D=1
Wink	On-hook for 50 to 1000 milliseconds, then off-hook for 30 to 600 milliseconds, and then on-hook again
Delay Dial	On-hook for 30 to 16000 milliseconds, then off-hook for 30 to 16000 milliseconds, and then on-hook again
Pause	Wait 1 second

NOTE: A 70 millisecond delay is inserted before the first dial pulse or DTMF digit, as well as before any on-hook or off-hook event.

The received events must have the following characteristics to be detected:

Event:	Received Characteristics:
Dial Pulse Digit	7 to 21 pps, 40 to 68% break value, with >300 milliseconds between digits
DTMF Digit	≥40 milliseconds On, ≥40 milliseconds Off
On-Hook	Terminating: A=0, Originating: A=0 for > 100 milliseconds
Off-Hook	Terminating: A=1, Originating: A=1 for > 600 milliseconds
Wink	On-hook, then off-hook for 70 to 600 milliseconds, and then on-hook again
Delay Dial	On-hook, then off-hook for 70 to 16000 milliseconds, and then on-hook again

Delay and timing measurements are made for the following received terminating events:

Wink
Delay Dial
Off-Hook

Delay and timing measurements have the following characteristics:

Event:	Delay:	Duration:
Wink	0 to 16 seconds	70 to 600 milliseconds
Delay Dial	0 to 16 seconds	70 to 16000 milliseconds
Off-Hook	0 to 60 seconds	>600 milliseconds

Delay dial — a temporary off-hook signal (an on-hook, off-hook, on-hook sequence) sent in response to indicate that the terminating end is ready to receive digits.

Dial pulse digits — digits generated using a method of alternately opening and closing a contact through which DC current flows. There can be up to 80 digits in the pulse format.

DTMF digits — digits generated using set combinations of two specific voiceband frequencies. There can be up to 80 digits in the dual tone multifrequency (DTMF) format.

Off-hook — a signal indicating that a device is seizing the line.

On-hook — a signal indicating that a device is releasing the line (the idle condition).

Pause — a 1-second wait before the next sequence event is sent.

Wink — a temporary off-hook signal. The signaling goes from on-hook, to a temporary off-hook, and back to on-hook.

When **Supervision** is set to **Terminating**, and either Receive Dial Pulse Digits or Receive DTMF Digits is displayed in the **Content** box, and **Add** is clicked on, the Dial Pulse/DTMF Receive Digits dialog box (see Figure 9-6) is visible in the window. Enter the number of digits (1 to 80) for either pulse digits or DTMF digits that are expected to be received, then click on **OK** to add the selected content line to the connection sequence and return to the T1 Switched 56 (DDS) Emulation Mode window.

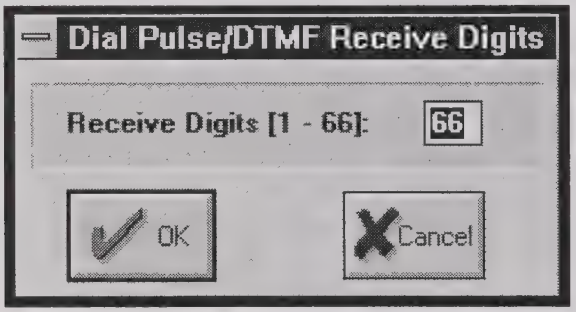

Figure 9-6
The Dial Pulse/DTMF Receive Digits Dialog Box

However, when **Supervision** is set to **Originating** and either Receive Dial Pulse Digits or Receive DTMF Digits is displayed, clicking on **Add** respectively displays either the Dial Pulse String dialog box or the DTMF String dialog box. Click on **OK** after you enter the number to be transmitted and return to the T1 Switched 56 (DDS) - Emulation Mode window. Clicking on **Cancel** leaves the number of digits as the last saved value and exits the dialog box back to the T1 Switched 56 (DDS) - Emulation Mode window.

Add — adds the displayed content line as the next connection sequence (up to 80 events can be specified). Each time you click on **Add**, the displayed content line is added to the connection sequence series.

Add can be used to insert an event in an existing connection sequence by performing the following steps:

1. Select the event to be added in the Event box.

2. Click on the **Connection Sequence** that you want the event to be inserted after.

3. Click on **Add**.

NOTE: Each digit transmitted is considered to be a separate sequence. For example, if you transmit an 11-digit number for event number 4, the next sequence number is 15.

The content line is inserted into the Event box and the sequence numbers after the inserted content line are renumbered.

Remove — deletes the highlighted connection sequence from the displayed series and renumbers the remaining connection sequences. For example, clicking on **Remove** when connection sequence 15 is highlighted deletes what is currently listed for that connection sequence. Connection sequence 14 is then highlighted, what was connection sequence 16 becomes 15, and the total number decreases by 1. Each time **Remove** is clicked on, the same renumbering event occurs until no connection sequences are left.

Remove All — deletes all connection sequences at one time.

Edit — is grayed out unless Receive/Transmit DTMF Digits or Receive/Transmit Dial Pulse Digits is highlighted in the Event box. Clicking on one of these sequences displays the Dial Pulse/DTMF Receive Digits dialog box (when **Supervision** is set to **Terminating**), which allows the number of receive digits (1 to 80) to be changed. However, when **Supervision** is set to **Originating**, and either Receive/Transmit Dial Pulse Digits or Receive/Transmit DTMF Digits is displayed, clicking on **Edit** respectively displays either the Dial Pulse String dialog box or the DTMF String dialog box, which allows you to edit the displayed number string.

Start — initiates the connection sequence, displays the SW56 Events window (see Figure 9-7), and displays each event as it occurs. Figure 9-7 is an example of the SW56 Events window when **Supervision** is set to Terminating.

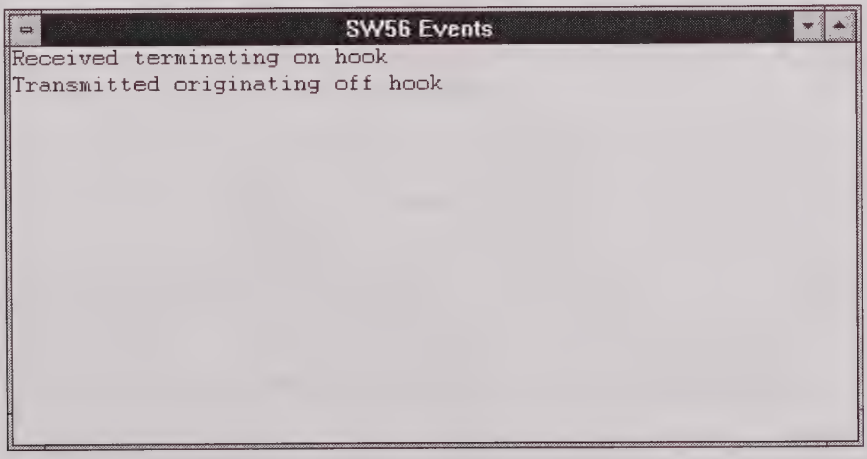

Figure 9-7
SW56 Events Window

Hang Up — performs the associated on-hook sequence for the supervision selection and terminates the connection.

Supervision Selection:	Hang Up:
Originating	Transmit Originating On Hook
Terminating	Transmit Terminating On Hook

Save — displays the Save As window when clicked for the first time, allowing you to enter a file name. If the file name is not valid (click on **F1** for on-line help concerning file names and disallowed characters), a dialog box appears indicating such. Click on **OK** in the dialog box and then type in a valid file name. When the file name is correct, click on **OK** to save the Connection Sequence in memory. Clicking on **Save** again overwrites the previous file stored in memory (with the same name) with the current Connection Sequence.

.trm — the default file extension when **Supervision** is set to **Terminating**
.org — the default file extension when **Supervision** is set to **Originating**

Save As — allows the current connection sequence to be saved in a file other than the one it is currently saved under. Clicking on **Save As** displays the Open window and allows you to specify the directory, path, and file name for the Connection Sequence to be saved.

Open — allows a previously saved file containing a connection sequence to be opened.

Transmitted Wink — provides control of the transmit wink parameters.

Delay	The delay time (50 to 1000 ms, in 10 ms increments) before wink transmission.
Duration	The length of time (30 to 600 ms, in 10 ms increments) a wink is transmitted.

Transmitted Delay Dial — provides control of the transmit delay dial parameters.

Delay	The delay time (30 to 16000 ms, in 10 ms increments) before delay dial transmission.
Duration	The length of time (30 to 16000 ms, in 10 ms increments) for delay dial transmission.

Help — allows context-sensitive help to be displayed for the selected function.

T1 Top Level — exits the T1 Switched 56 (DDS) window and redisplays the T1 Configuration - Top Level window.

9.5 LOOPBACK...

Clicking on **Loopback...** displays the T1 Loopback Configuration window (see Figure 9-8). The T1 loopback configuration selection determines the type of loopback code transmitted for T1 BERT.

NOTE: With **Self Loop** enabled, the **Loopback** button is grayed out.

The following sections describe the selections in the T1 Loopback Configuration window.

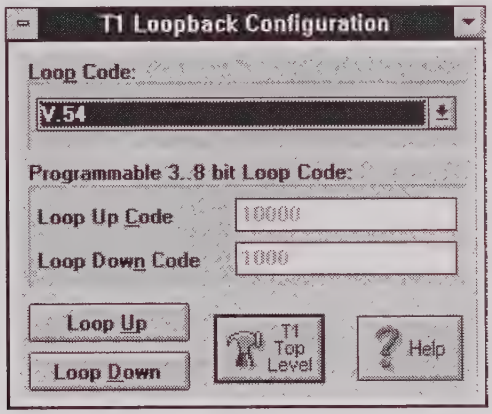

Figure 9-8
T1 Loopback Configuration Window

Loop Code — selects the type of repeating loopback code that is transmitted until synchronization is detected with the loop code being transmitted. **Loop Code** choices are:

Loop Code:	Loop Up:	Loop Down:
V.54	127-bit pseudorandom code	127-bit pseudorandom code
CSU	10000	100
Facility Loop Code 1	1100	1110
Facility Loop Code 2	11000	11100
3...8 bit programmable	User Defined	User Defined
T1.403 Line Loopback	1111 1111 0111 0000	1111 1111 0001 1100
T1.403 Payload Loopback	1111 1111 0010 1000	1111 1111 0100 1100
T1.403 Network Loopback	1111 1111 0100 1000	1111 1111 0010 0100

NOTE: CSU, 3…8 bit programmable, Facility Loop Code 1, and Facility Loop Code 2 are only available when **T1 Mode** is set to **Full T1**. T1.403 LLB, T1.403 PLB, and T1.403 NLB are available when **Framing** is set to **ESF**.

Selecting **3...8 bit programmable** allows you to enter a 3- to 8-bit loop code that is to be transmitted. The default Loop Up code is 10000 and the default Loop Down code is 1000.

Loop Up — repeatedly transmits the selected loop code until the other side comes into synchronization, up to a maximum of 30 seconds (depending on the type of loop code transmitted). Clicking on **Cancel** halts loop code transmission. A dialog box is displayed while the loop-up code is being transmitted. For example, selecting CSU, 3...8 bit programmable, Facility Loop Code 1, or Facility Loop Code 2 as the Loop Code and clicking on **Loop Up** displays the Loop Up In Progress window (see Figure 9-9), which contains the number of seconds remaining for code transmission.

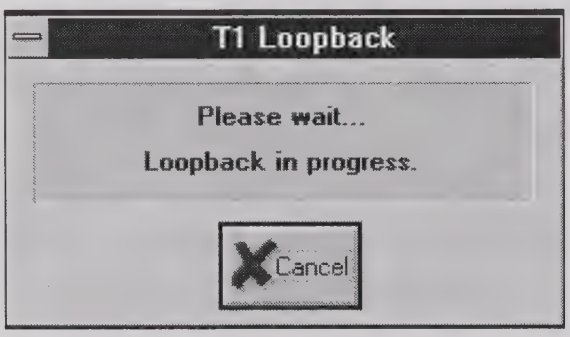

Figure 9-9
Loop Up In Progress Window

Loop Down — repeatedly transmits the selected loop code until synchronization is no longer detected on the other side, to a maximum of 30 seconds. Clicking on the **Cancel** box halts loop code transmission.

T1 Top Level — exits the T1 Loopback Configuration window and returns to the T1 Configuration - Top Level window.

Help — allows context-sensitive help to be displayed for the current window.

WAN — grayed out.

Test Restart — clears all accumulated test results, starts accumulating results totals, and displays the Results window.

SECTION 10
T1 ISDN PRI BERT

10.1 SECTION OVERVIEW

This section describes the choices available when T1 ISDN PRI BERT is the **Test Type** selection.

10.2 T1 ISDN PRI BERT

Selecting **T1 ISDN PRI BERT** as the current **Test Type** displays the configuration window shown in Figure 10-1. This **Test Type** selection allows you to perform WAN protocol analysis on the D-channel and BER testing on the bearer channel.

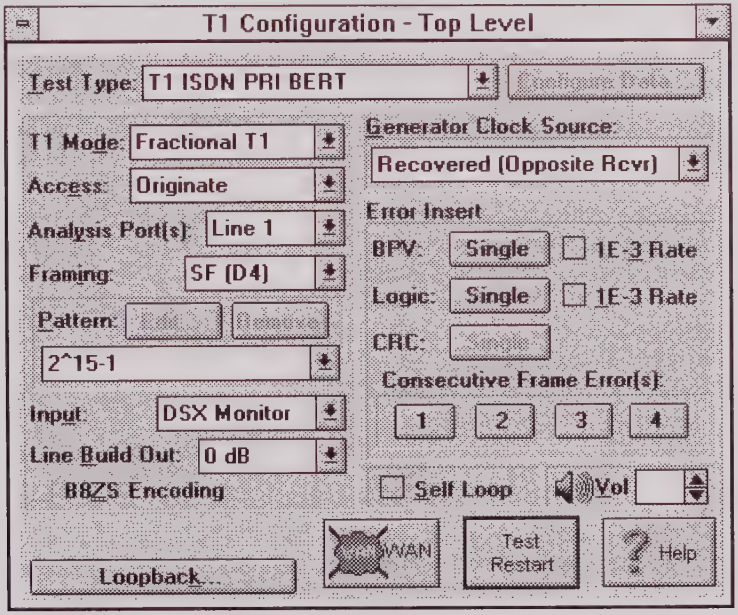

Figure 10-1
T1 ISDN PRI BERT Configuration Window

When you select T1 ISDN PRI BERT as the **Test Type**, you will see the dialog box displayed in Figure 10-2.

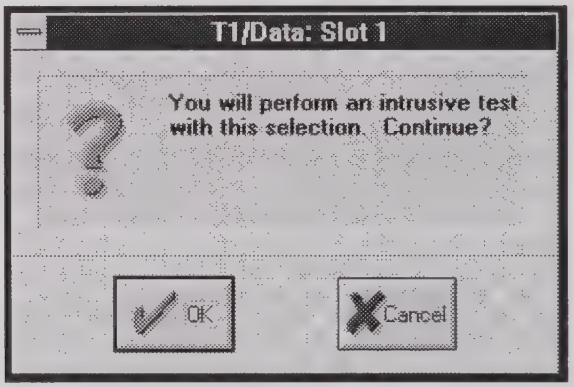

Figure 10-2
Intrusive Test Dialog Box

This dialog box indicates that the test you are going to initiate is intrusive. Click on **Cancel** to cancel the T1 BERT test or click on **OK** to proceed with the configuration window display.

NOTE: The intrusive warning dialog box can be turned off by clicking on Options to display the choices. Clicking on **Intrusive Warning** removes the check mark and prevents the intrusive warning dialog box from being displayed when an intrusive test it going to be performed.

T1 Mode — selects the mode of T1 operation. The only T1 Mode choice is:

Fractional T1	Fractional T1 window available

Access — selects the type of access used to conduct the test. Choices include:

Originate	Transmit and receive. Used for intrusive testing when transmitting and receiving data. Note that when **Access** is set to **Originate**, the B- and D-channel selection is determined in the WAN application.

Analysis Port (s) — selects the port for analysis and transmission of data. Choices are:

Line 1	Performs analysis on the port typically connected to the DCE (network) side. Line 1 should be connected to the DCE side.
Line 2	Performs analysis on the port typically connected to the DTE (CPE) side. Line 2 should be connected to the DTE side.

Framing — selects the type of framing expected on the received signal and the format selected when transmitting. Choices are:

SF (D4) — Expects to receive T1 signals with D4 (SuperFrame) framing. SF framing occupies 8 kb/s of the 1.544 Mb/s bandwidth, with the data occupying the remaining 1.536 Mb/s. SF framing is compatible with D1D, D2, D3, and D4 channel banks.

ESF — Expects to receive T1 signals with Extended SuperFrame (ESF) framing format. ESF framing occupies 2 kb/s, CRC occupies 2 kb/s, and the data link occupies 4 kb/s, with the data occupying the remaining 1.536 Mb/s.

Pattern — selects the test pattern for BERT use only. **Pattern** choices are:

All-Ones (Mark) — A repeating pattern of all 1s. Equivalent to the red alarm signal. Provides maximum power level for T1 signal.

All-Zeros (Space) — A repeating pattern of all 0s. Use this pattern instead of All-Ones when you require an inverted data pattern.

1:1 — A repeating pattern of a 1 followed by a 0. Use this pattern to perform a minimum-level stress test on clock recovery circuits.

63 — A 63-bit (2^6-1) pseudorandom pattern with a maximum of 5 sequential 0s, and 6 sequential 1s. Provides the lowest stress of any pseudorandom pattern.

511 — A 511-bit (2^9-1) pseudorandom pattern with a maximum of 8 sequential 0s and 9 sequential 1s. Compatible with DDS equipment, this pattern is recommended when testing at data rates below 9.6 kb/s.

2047 — A 2047-bit (2^11-1) pseudorandom pattern with a maximum of 10 sequential 0s and 11 sequential 1s. Compatible with DDS equipment, this pattern is recommended when testing at data rates between 9.6 kb/s and 56 kb/s.

2^15-1 — A 32,767-bit pseudorandom pattern with a maximum of 14 sequential 0s and 15 sequential 1s. Compatible with CCITT specifications for data rates of 64, 1544, 2048, 3152, and 6312 kb/s. Provides the maximum number of sequential 0s allowed in framed, non-B8ZS testing. This pattern is standard for G.703 testing.

2^20-1

A 1,048,575-bit pseudorandom pattern with a maximum of 19 sequential 0s and 20 sequential 1s. Recommended for T1 applications where excess zero transmission is required.

2^20-1R

A reverse of the 2^20-1 pattern with 20 sequential 0s and 19 sequential 1s.

2^23-1

An 8,388,607-bit pseudorandom pattern with a maximum of 22 sequential 0s and 23 sequential 1s. The highest stress of all pseudorandom patterns.

2^23-1R

A reverse of the 2^23-1 pattern with 22 sequential 1s and 23 sequential 0s.

QRSS

A 1,048,575-bit (2^20-1) quasi-random signal source pattern that has been modified to transmit a maximum of 14 consecutive 0s. This is the standard pattern for T1 testing and can be used to simulate live data.

New Bit Pattern...

Displays the User Bit Pattern Editor window, which allows you to name and create a 3- to 24-bit pattern using the numeric keys. Click on the 3-24 Bit Binary Pattern box, then use the 1 and 0 keys to enter the desired bit pattern. Once the pattern is set, click on **OK** and exit the User Bit Pattern Editor window. New patterns are added to the bottom of the pattern list and are preceded by **+>**. This pattern is frame-aligned so as not to cause RAI (Remote Alarm Indication) (Yellow Alarm) to be generated in SF (D4) framing.

1:3

A repeating pattern of a single 1 followed by three 0s. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.

1:7

A repeating pattern of a single 1 followed by seven 0s. The maximum stress of the one's density (12.5%) requirements for T1 circuits. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.

2 in 8

A repeating pattern of two 1s in an 8-bit pattern. This pattern contains a maximum of 4 consecutive 0s. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.

3 in 24	A repeating pattern of a single 1 followed by 3 consecutive 0s (three times) followed by 15 consecutive 0s. This pattern provides the lowest 1s density (12.5%), and provides the maximum stress of the zero requirement for T1 circuits in a 24-bit pattern. This pattern is frame-aligned so as not to cause RAI (Yellow Alarm) to be generated in SF (D4) framing.
T1-1 (Min-Max)	A fixed 72-octet hexadecimal pattern used for stress testing the repeater preamplifier and automatic line build-out (ALBO) circuitry. Use this pattern to detect marginal equipment using rapid transitions from low 1s density to high 1s density.
T1-2 (Trip-Test)	A fixed 96-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
T1-3	A fixed 54-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
T1-4	A fixed 120-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
T1-5	A fixed 53-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
T1-6	A fixed 55-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
T1-Milliwatt	A fixed pattern of 247 bytes simulating a digitized 1004 Hz tone with a 0 dBm0 level on one DS-0 channel. Provides a standard tone for voice testing.
T1-Daly	A fixed 72-octet hexadecimal pattern used for empirical stress testing of T1 circuits and equipment.
DDS-1	A fixed pattern of 100 octets of all 1s (1111 1111) followed by 100 octets of all 0s (0000 0000).
DDS-2	A fixed pattern of 100 octets of 0111 1110 followed by 100 octets of all 0's (0000 0000).
DDS-3	A fixed pattern of 0100 1100.
DDS-4	A fixed pattern of 0000 0010.

DDS-5	A fixed pattern consisting of DDS patterns 1 through 4.
DDS-6	A fixed pattern of 7 octets of 1111 1110 followed by 1 octet of 1111 1111.

Edit... — allows you to change a bit pattern that you have created (a pattern preceded by **+>**). To change a pattern, highlight the pattern name to be edited, then click on **Edit...**. You can change the bit pattern or the number of bits in the pattern, but you cannot change the pattern name.

If you immediately change a pattern, while editing, all highlighted bits are deleted. If you want to change only one or two bits, click on the pattern at the place you want to change the existing pattern. The Pattern Name box is grayed out, which prevents you from changing the pattern's name. Click on **OK** to save the new changes under the old pattern name. Click on **Cancel** to prevent any changes from taking place and redisplay the T1 Configuration - Top Level window.

Remove — deletes the highlighted pattern and pattern name that you created. Bit patterns that you created can be deleted by clicking on the pattern name that you want to delete and then clicking on **Remove**.

Input — selects the input impedance for the unit. Choices are:

Terminating	Provides 100Ω input impedance to a properly terminated line. Accepts T1 signals between +6 dB and -35 dB (or -24 dB in the presence of jitter, as per PUB62411) and provides compensation for cable loss.
DSX Monitor	Like terminating, provides 100Ω input impedance to a properly terminated line. Accepts T1 signals that have been resistively attenuated between 10 dB and 30 dB at the monitor jack.
Bridging	Provides >1 kΩ input impedance to a properly terminated line.

Line Build Out — selects the line build-out signal reduction. Choices are:

0 dB	Sets the transmit (Tx) output to the DSX level with no line build-out.
-7.5 dB	Provides -7.5 dB line build-out, thus simulating 7.5 dB of attenuation due to cable loss.
-15 dB	Provides -15 dB line build-out, thus simulating 15 dB of attenuation due to cable loss.

B8ZS Encoding — selects whether B8ZS encoding is used on transmitted data. Clicking on the box or label toggles the B8ZS encoding selection to its opposite condition (e.g., from off to on).

Generator Clock — selects the timing source for the generator clock. Choices are:

Internal (1.544 MHz Fixed)	Selects the internal oscillator as the generator clock source for transmit timing. The internal oscillator has a frequency accuracy of ±10 ppm.
External (BNC)	Selects the external BNC connector as the generator clock source for transmit timing. The input impedance is 50Ω and the signal must be a square wave, from 1.5 V to 5.0 V peak-to-peak, with a 0 V DC offset ±100 mV.
Recovered	The generator clock is recovered from the received signal on the same line.
Recovered (Opposite)	The generator clock source is recovered from the opposite T1 line. This selection is required for Drop & Insert.

Error Insert — allows errors to be entered at different error rates into the data stream. The following errors can be inserted into the data stream by clicking on the **Single** key or by clicking on the rate box, if available:

BPV (bipolar violation)	Single or 1E-3. Clicking on **Single** inserts a single error into the data stream (by inverting the polarity of the 1 bit). Clicking on **1E-3** inserts 1 BPV error every 1000 bits when a check mark is in the box.
Logic	Single or 1E-3. A single logic error is inserted into the data stream each time **Single** is clicked on. Clicking on **1E-3** toggles the error insertion to its opposite condition. This does not cause CRC errors for ESF.
CRC	Single. A single Cyclic Redundancy Check error is inserted each time **Single** is clicked on. CRC errors can only be inserted when **Framing** is set to **ESF**. CRC errors do not cause bit errors.

Consecutive Frame Error(s) — selects the number of adjacent frames that are errored. Choices are:

1	inserts a bit error in 1 frame in the transmitted data stream.
2	inserts a bit error in 2 consecutive frames in the transmitted data stream.
3	inserts a bit error in 3 consecutive frames in the transmitted data stream.
4	inserts a bit error in 4 consecutive frames in the transmitted data stream.

NOTE: Generating 2, 3, or 4 consecutive frame errors cause Frame Sync Loss when in self-loop mode.

In addition to inserting errors on the T1 Configuration - Top Level window, error insert switches are included on the toolbar. Clicking on the error switch inserts a single error of that type into the transmitted data stream. The error insert switches are grayed out if that error insert type is not allowed for the test being performed. Error insert switches include:

T1 Logic Err	inserts a single logic error in the transmitted data stream.
T1 BPV Err	inserts a single bipolar violation error in the transmitted data stream.
T1 CRC Err	inserts a single CRC error in the transmitted data stream.
T1 Frame Err	inserts a single frame error in the transmitted data stream.

Self Loop — selects the self-loop mode. In this mode, you can test the transmitter and receiver circuits of the selected data interface before connecting the test instrument to a circuit. The self-loop mode allows you to verify proper unit operation without disrupting traffic on the line. Clicking once on **Self Loop** toggles it to its opposite condition (ON or OFF).

NOTE: When in self-loop, the use of "drop dead" relays allows T1 data to pass through when in the drop and insert configuration.

10.2.1 Loopback...

Clicking on **Loopback...** displays the T1 Loopback Configuration window shown in Figure 10-3. The T1 loopback configuration selection determines the type of loopback code transmitted for T1 BERT.

NOTE: With **Self Loop** enabled, the **Loopback** switch is grayed out.

The following sections describe the selections in the T1 Loopback Configuration window.

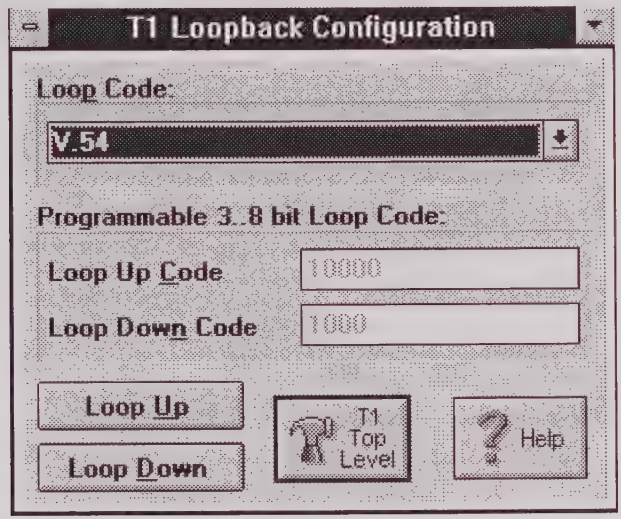

Figure 10-3
T1 Loopback Configuration Window

Loop Code — selects the type of repeating loopback code that is transmitted until synchronization is detected with the loop code being transmitted. **Loop Code** choices are:

Loop Code:	Loop Up:	Loop Down:
V.54	127-bit pseudorandom code	127-bit pseudorandom code

Loop Up — repeatedly transmits the selected loop code until the other side comes into synchronization, to a maximum of 30 seconds (depending on the type of loop code transmitted). Clicking on **Cancel** halts the loop code transmission. A dialog box is displayed while the loop code is transmitted; for example, selecting CSU as the Loop Code and clicking on **Loop Up** displays the Loopback In Progress window (see Figure 10-4).

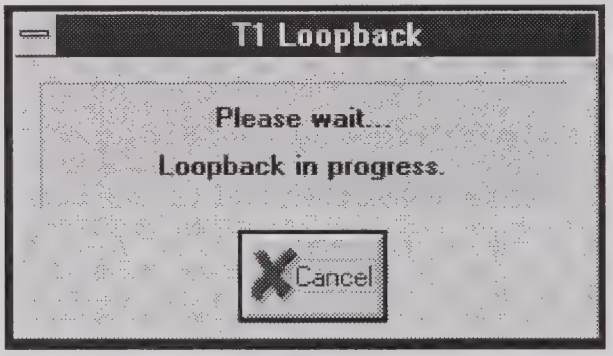

Figure 10-4
Loopback In Progress Window

Loop Down — repeatedly transmits the selected loop code until synchronization is no longer detected on the other side, to a maximum of 30 seconds. Clicking on the **Cancel** box halts the loop code transmission.

T1 Top Level — exits the T1 Loopback Configuration window and returns to the T1 Configuration - Top Level window.

Help — allows context-sensitive help to be displayed for the current window.

WAN — is grayed out.

Test Restart — clears all accumulated test results, starts accumulating results totals, and displays the Results window.

SECTION 11
T1/DATA MENUS

11.1 SECTION OVERVIEW

This section describes the T1/Data menu choices.

11.2 MENU CHOICES

The T1/Data menu bar is displayed across the top of the T1/Data window. Click on the menu choices to display a drop-down list of menu choices available for the selected menu. The following list indicates the choices available on the T1/Data menu bar:

File — establishes new configurations, saves the current configuration, recalls saved configurations and other common T1/Data test module functions.

Test-Manager! — returns you to the Test Manager window.

Options — enables or disables the display of the toolbar, the information line, and the intrusive warning dialog box.

Action — restarts a test, halts information visible on the display, or initiates a demonstration mode.

Results — allows you to customize available results for the selected test configuration.

Log — allows you to customize a list of events to generate a log for the selected test configuration.

Window — controls how windows and icons are arranged.

Help — provides help information and system information.

These menus are always available. You can click on the menu item to display a list of menu choices, or another window (e.g., when you click on **Test-Manager!** the Test Manager window is displayed).

11.2.1 The File Menu

File menu choices allow you to perform T1/Data module configurations and file management functions. Clicking on the **File** menu item displays the following menu choices:

Menu Item:	Shortcut:	Description:
New Test	Ctrl+N	Sets test setup to the default.
Open Test Setup...	Ctrl+O	Opens a test setup file. Displays the Open window.
Save Test Setup	Ctrl+S	Saves the current T1/Data test setup.
Save Test Setup As...		Saves the current T1/Data test setup in a new file.
User Info...		Edit user information.
Print/Report...	Ctrl+P	Generates or prints a report.
Exit	Alt+F4	Terminate application.

Select a **File** menu item by either highlighting the menu item and pressing the trackball select button, or by pressing the **Ctrl** key and underlined letter key simultaneously. For example, to open a test setup, press the **Ctrl** and **O** keys simultaneously.

The following paragraphs describe the menu choices available on the **File** menu items.

New Test — sets the T1/Data test module to its default condition, which is determined by the mainframe configuration. For example with the WAN option installed, clicking on **New Test** displays the Data Configuration window shown in Figure 11-1.

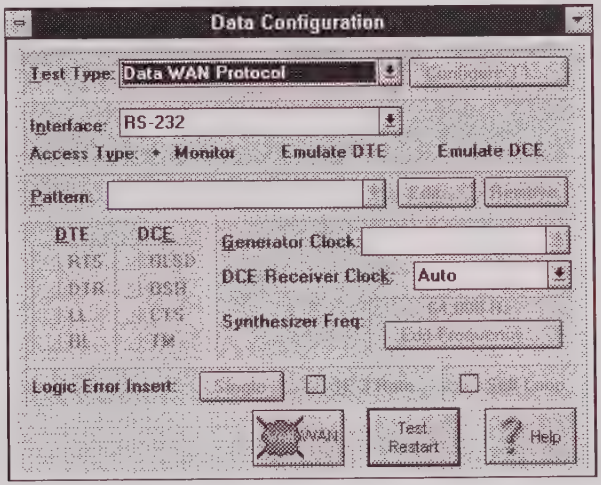

Figure 11-1
New Test Data Configuration Window

Open Test Setup... — displays the Open window (see Figure 11-2). With the Open window displayed, you can configure the T1/Data module as specified in the selected filename. You can also specify the drive, the directory, the type of file, and the file name. This allows you to determine where the file is searched for and what type of file is searched. The default file extension for T1/Data configurations is .TDI.

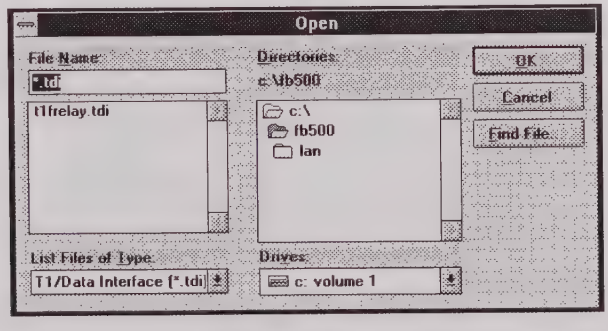

Figure 11-2
Open Window

If desired, you can click on **Find File...** to find a file of specific interest. When you click on **Find File...**, the path searched is the path in the open configuration window. You cannot change the directory (the path searched) from the Find File Application window (see Figure 11-3).

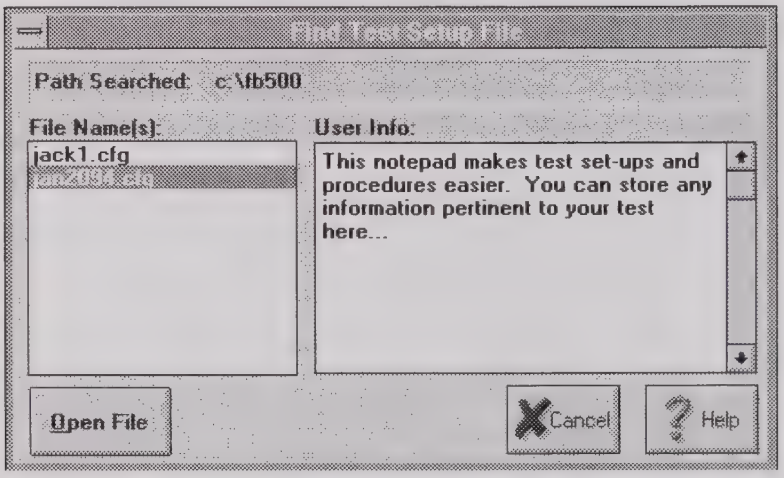

Figure 11-3
Find File Application Window

Save Test Setup — saves the current T1/Data configuration in the designated file on disk. When clicked on for the first time, the Save As window is displayed for you to designate the filename (with .tdi as the default file extension), directory, and drivers for the current configuration to be saved in. Once the currently open configuration has been previously saved, clicking on this menu item saves the current configuration into the file with the same filename. Previous information in that file is overwritten with the currently displayed configuration information.

NOTE: The **Save Test Setup** and **Save Test Setup As...** selections only save T1/Data test module information, mainframe configuration information is not saved. To save the entire mainframe configuration, you must perform a save from the Test Manager window.

This function can be used to update a configuration as you go along, or allows you to have a basis from which you customize the configuration for a specific test. For example, this means that you could set up a configuration for data BERT and a configuration for T1 BERT, allowing you to begin testing more quickly.

Save Test Setup As... — saves the current T1/Data configuration in the filename that you specify. When the Save As window is displayed (see Figure 11-4), you specify the filename, directory, and drive. T1/Data configuration files have a default file extension of .TDI to help you quickly identify configuration files. This function allows you to easily save new test configurations in another file without overwriting the file from which the current configuration originated.

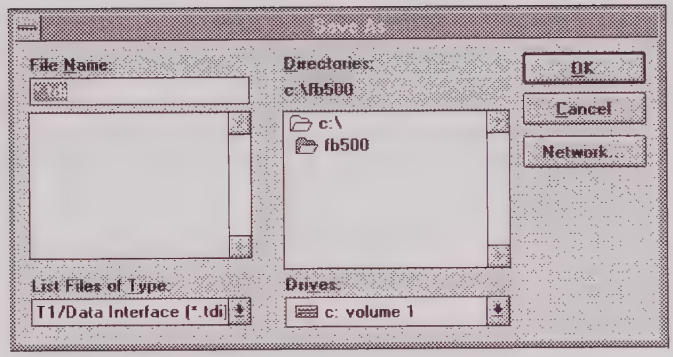

Figure 11-4
Save As Window

User Info... — provides you with an electronic notepad that allows you to enter information about the current configuration. To save the information that you have typed in, you must save the current configuration. Once saved, you can view this information by clicking on the file name in the Find File window, or by clicking on **User Info...** again.

Print/Report... — displays the Print/Report window (see Figure 11-5), which allows you to generate a print or a report. For more information on the Print/Report window, you can refer to the Windows manual.

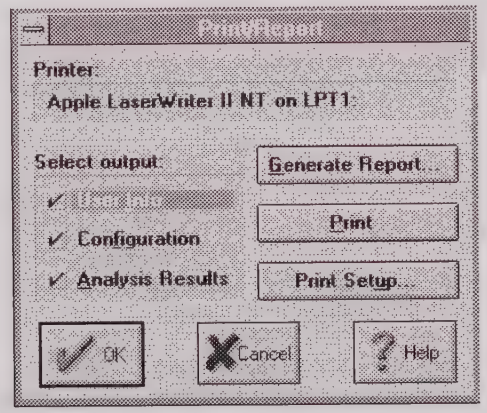

Figure 11-5
Print/Report Window

11.2.2 The Options Menu

Options menu choices allow you to select whether you want the toolbar and information line to be displayed. Clicking on the displayed menu item enables or disables these displays. If a check mark appears next to the menu item, it indicates that it is enabled and is available on the T1/Data configuration window. No check mark indicates that the menu item is not enabled and is not displayed on the configuration window. Clicking on the **Options** menu item displays the following menu choices:

Toolbar	Displays icons. By clicking on an icon you can perform a function without having to select it through a drop-down menu.
Information Line	Displays information at the bottom of the window that briefly describes the highlighted function.
Intrusive Warning Ctrl+W	Displays the intrusive warning dialog box where an intrusive test is going to be performed.

11.2.3 The Action Menu

Action menu choices allow you to perform test-related activities. These activities include restarting a test, halting the display, or initiating the demonstration mode. Clicking on the **Action** menu item displays the following menu choices:

Test Restart Ctrl+R	Restarts a currently running test and clears all accumulated results values.
Display Hold Ctrl+D	Halts the updating of results so that you can view all displayed results at that point in time. Although the display results are no longer being updated, results continue to accumulate.
Demo Mode	Allows the results and status LEDs to simulate a test scenario.

11.2.4 The Results Menu

Results menu choices allow you to perform results-related activities. These activities include customizing results, selecting the result font, or selecting the results color. Clicking on the **Results** menu item displays the following menu choices:

Customize Results Ctrl+T	Displays the Result Setup window. Refer to Section 4 for more information on this menu selection.

Result Font... Displays the Font window, which allows you to chose the Font, Font Style, Size, and Color for the displayed results text. A Sample area is provided to give you an indication of how the selection would appear. Information is included below the Sample area that describes the selected font.

Result Color... Displays the Color window, which allows you to select basic colors and custom colors for lines and borders of the results display.

11.2.5 The Log Menu

Log menu choices allow you to perform logging-related actions. These actions include customizing log results and clearing the log. Clicking on the **Log** menu item displays the following menu choices:

Customize Log... Ctrl+L Displays the Log Manager Setup window. Refer to Section 4 for more information on this menu selection.

Clear Log Clears data that has been logged to the Log Display window.

11.2.6 The Window Menu

Window menu choices allow you to perform window-organizing actions. Clicking on the **Window** menu item displays the T1/Data windows that can be opened and the following menu choices:

Cascade Overlaps the windows in a stepped order.

Arrange Icons Arranges minimized icons in a symmetrical order.

11.2.7 The Help Menu

Help menu choices allow you to perform help-related activities. These activities include listing the help contents, searching for help on a specific menu item, how to use help, and information about the current software version. Clicking on the **Help** menu item displays the following menu choices:

Contents F1 Displays the Help table of contents.

Search for Help On... Displays the Search dialog box.

How to Use Help Displays help on how to use Help.

About... Displays the About window, which contains TTC's logo, software version number, hardware version number, and copyright notice. Click on **OK** to exit this window.

Exit Help by clicking on **File** and then clicking on **Exit**, or by pressing **Alt** + **F4**.

11.3 TOOLBAR ICONS

The toolbar icons can be added or deleted by clicking on **Options** in the menu bar, and clicking on Toolbar to toggle it to its opposite condition. When there is no check mark next to Toolbar, no toolbar is displayed. If a check mark is next to Toolbar, the toolbar is displayed.

Icons displayed in the toolbar provide a quick way to access common T1/Data functions. Icons displayed on the toolbar perform the same function as clicking on an icon displayed on the T1/Data window or clicking on a key on a configuration window. These icons are:

Icon:	Description:
	Open Configuration File — displays the Open window, which allows you to select the configuration file that you want to open. This icon is identical in function to clicking on **Open Test Setup...** on the File menu.
	Save Current Configuration — saves the current operating configuration. Clicking on this icon displays the Save As window the first time the current configuration is saved. Subsequent saves overwrites previous information with the current configuration data. This icon is identical in function to clicking on **Save Configuration** on the **File** menu.
	Top Level — displays the T1/Data configuration window after it has been minimized.
	Chart — displays the Status window for the current configuration. The status window displayed is determined by the configuration that you have selected. Figure 11-6 is an example of the status window for Data BERT RS-232. This icon is identical in function to clicking on the status icon on the T1/Data configuration window.

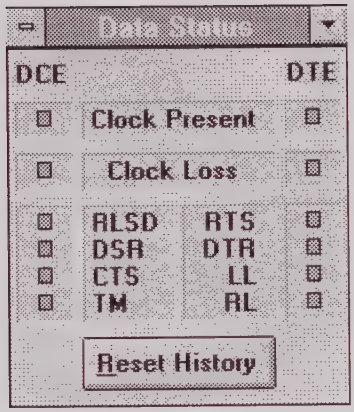

Figure 11-6
Data Status Window

Icon:	Description:
	Result — displays the results window for the current test. The results displayed are determined by the selected interface and by the results you choose to display (refer to the following section for information on selecting results). Figure 11-7 is a typical example of a results window. Results are selected by clicking on **Results** (from the T1/Data menu) and selecting the results that you want to display. This icon is identical in function to clicking on the result icon or on **Test Restart** in the current configuration window.

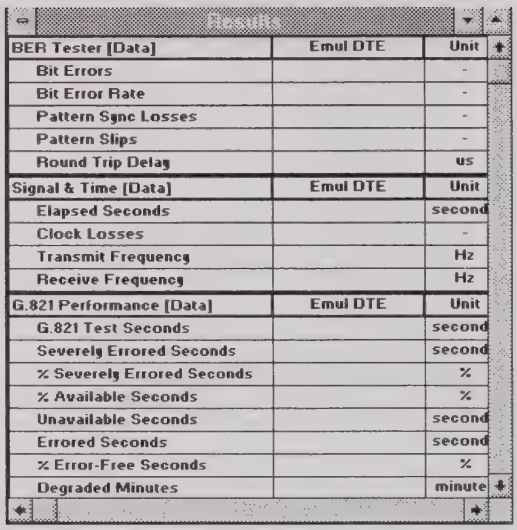

Figure 11-7
Results Window

Icon:	Description:
	Log — displays the current log for the test in progress. The results that you want to log are selected by clicking on **Customize Log...** on the **Log**. This icon is identical in function to clicking on the log icon. (Refer to Section 12 for information on selecting log items.)
	Restart — restarts the test for the currently active interface. This icon is identical in function to clicking on the **Test Restart** key on the displayed configuration window.
	STOP/GO — enables/disables display hold. Clicking on this for the first time changes the sign from STOP to GO, indicating that display hold is enabled. Display hold halts the updating of status results and displays the day, date, and time the display hold was initiated in the status bar. While the updating of displayed results is halted, result values continue to accumulate. Clicking on the GO sign disables the display hold, displays the STOP sign again, and displays the current results values. The STOP sign indicates that the display hold is disabled, allowing the results to display the current results values.

When you click on the Data/T1 icon, up to five more icons may be seen on the tool bar. The number of additional icons available is determined by the selections made on the displayed configuration window.

Data Logic Err	inserts a single logic error in the data BERT.
T1 Logic Err	inserts a single logic error in the T1 BERT.
T1 BPV Err	inserts a single BPV error in the T1 BERT.
T1 CRC Err	inserts a single CRC error in the T1 BERT.
T1 Frame Err	inserts a single frame error in the T1 BERT.

Clicking on these icons allows you to insert the associated error into the transmitted data stream without having to access the configuration window and click on the corresponding error insert key.

SECTION 12
CUSTOMIZING LOGS AND RESULTS

12.1 SECTION OVERVIEW

You can customize the data that is logged and the results that are displayed to control what is visible on the display windows and on the printouts that are generated. This section describes the log and result configuration windows and how you can customize them to display information of interest for the tests you want to perform.

12.2 LOG MENU

Logging allows you to set the FIREBERD 300/500 for unattended operation, while generating "snapshots" at timed intervals. You can determine the events that are logged and the transition that causes an event to be generated.

To start the logging activity, click on **Log**, from the toolbar or the T1/Data window, then highlight **Customize Log...** to view the Log Manager Setup window (see Figure 12-1). Clicking on **Clear Log** clears data logged to the Log Display window (see Figure 12-2).

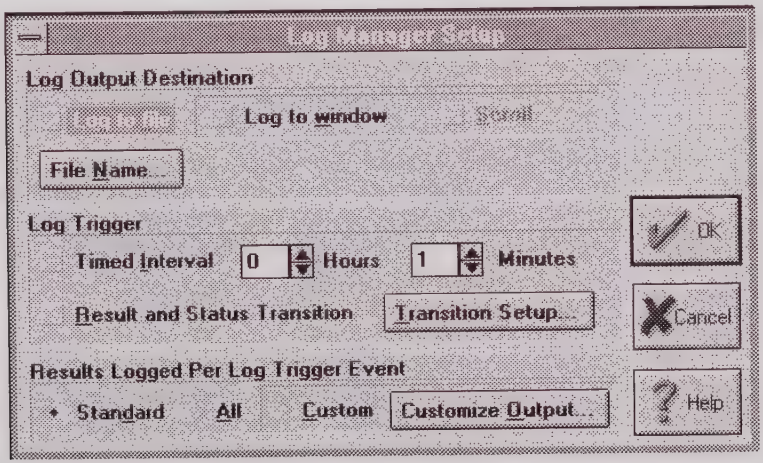

Figure 12-1
Log Manager Setup Window

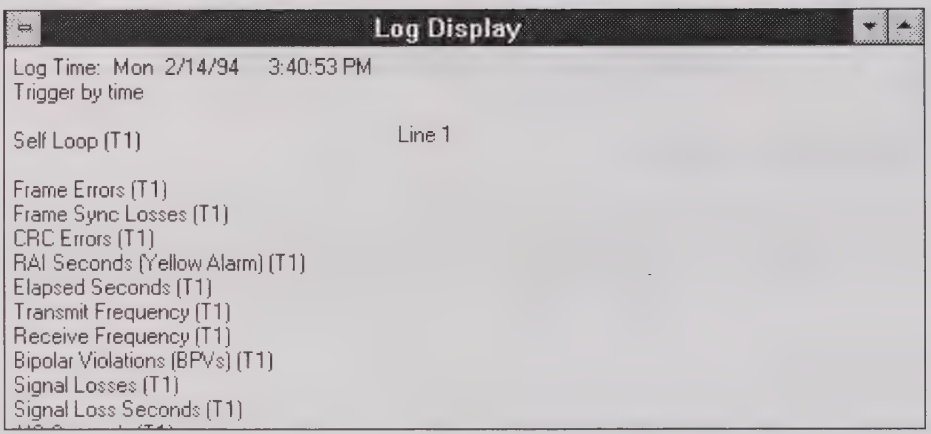

Figure 12-2
Log Display Window

Choices available in the Log Manager Setup window include:

Log Output Destination — determines where the log report is sent. Log Result choices are:

Log to file	Enables generated logs to be saved to the file specified by the **File Name...** selection.
Log to window	Enables the generation of logs to the Log Display window (see Figure 12-2). The Log Display window is a 2,400 line buffer that displays the most recent log data appended to the end. When the buffer is full, the oldest data (data entered first) is automatically overwritten.
Scroll	Determines how log data is scrolled on the Log Display window. When **Log to window** is enabled, data is scrolled line-by-line; when disabled, data can be scrolled page-by-page. This selection is grayed out unless **Log to window** is enabled.

File Name... — displays the Save Log As window (see Figure 12-3). Log files are quickly identified by the .LOG file extension. Enter the file name where the log is to be stored.

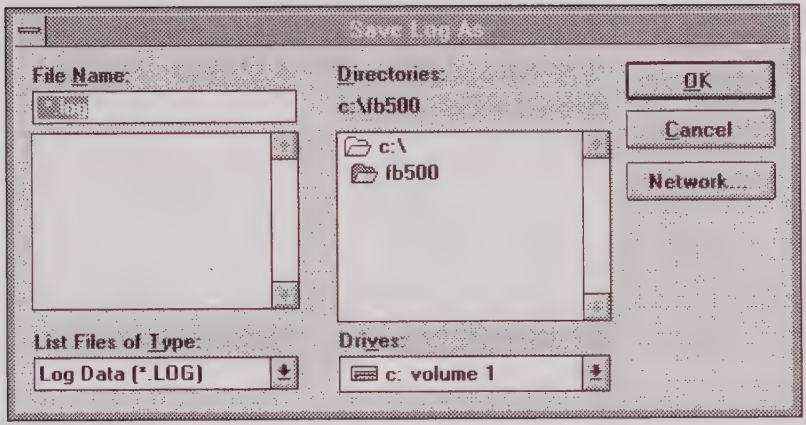

Figure 12-3
Save Log As Window

Log Trigger — determines what causes a log to be generated. Log Trigger choices are:

Timed Interval — selects the time interval in Hours and Minutes between log outputs. Choices are:

Hours - 0 to 72
Minutes - 0 to 60

Result and Status Transition — causes a selected result or status transition to generate a log output. The result value or trigger condition is set up on the Log Transition Setup window.

Transition Setup... — displays the Log Transition Setup window (see Figure 12-4). Log Transition window choices include:

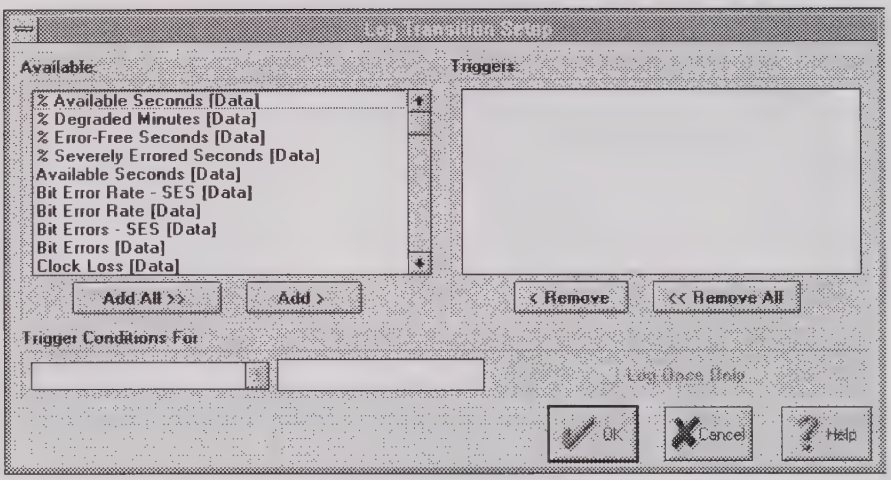

Figure 12-4
Log Transition Setup Window

Available: — lists the results and status conditions that can be selected to generate a log output. Click on a result displayed in the **Available:** listing to highlight it (can use **Shift**-click to highlight several results at once), then click on **Add >** to add the highlighted result(s) to the **Show:** listing. You can also double-click on a result in the **Available:** listing to add it to the **Show:** listing. Once an available result or status condition has been added, it is removed from the Available list and inserted in the Triggers list. Use the keys on the scroll bar to move through all the items on the Available list. The items listed are determined according to the current configuration. Available choices include:

% Available Seconds [T1] [Data]
% Degraded Minutes [T1] [Data]
% Error-Free Seconds [T1] [Data]
% Severely Errored Seconds [T1] [Data]
AIS Seconds [T1]
AIS [T1] [Data]
Available Seconds [T1] [Data]
B8ZS [T1]
Bipolar Violations [BPVs] [T1]
Bipolar Violations Rate [T1]
Bit Error Rate - SES [T1] [Data]
Bit Error Rate [T1] [Data]
Bit Errors - SES [T1] [Data]
Bit Errors [T1] [Data]
Clock Loss [Data]
Clock Losses [Data]
Clock Present [Data]
CRC Error Rate [T1]
CRC Errors [T1]
CS [Data]
CTS [Data]
Data Loss [Data]
Degraded Minutes [T1] [Data]
DM [Data]
DSR [Data]
DTR [Data]
Elapsed Seconds [T1] [Data]
Error-Free Seconds [T1] [Data]
Errored Seconds [T1] [Data]
Far 2 to 5 CRC Errored Seconds [T1]
Far 6 to 10 CRC Errored Seconds [T1]
Far 11 to 100 CRC Errored Seconds [T1]

Far 101 to 319 CRC Errored Seconds [T1]
Far >320 CRC Errored Seconds [T1]
Far BPV Seconds [T1]
Far Controlled Slip Seconds [T1]
Far Errored Events [T1]
Far Single Errored Seconds [T1]
Far Frame Errored Event Seconds [T1]
Far Severely Frame Errored Seconds [T1]
Frame Error Rate [T1]
Frame Errors [T1]
Frame Loss [T1]
Frame Sync Loss Seconds [T1]
Frame Sync Losses [T1]
Frame Sync [T1]
G.821 Test Seconds [T1] [Data]
LL [Data]
No Gen Clock [T1] [Data]
Pattern Loss [T1] [Data]
Pattern Slip [T1] [Data]
Pattern Slips [T1] [Data]
Pattern Sync [T1] [Data]
Pattern Sync Loss Seconds [T1] [Data]
Pattern Sync Losses [T1] [Data]
Payload Source & Loop Status [T1]
Performance Report Time [T1]
RAI (Yellow) [T1]
RAI Seconds (Yellow Alarm) [T1]
Receive Frequency [T1] [Data]
RL [Data]
RLSD [Data]
Round Trip Delay [T1] [Data]
RR [Data]
RS [Data]
RTS [Data]
Self Loop [T1] [Data]
Severely Errored Seconds [T1] [Data]
Signal Loss Seconds [T1]
Signal Losses [T1]
Signal Loss [T1]
Signal [T1] [Data]
TM [Data]
TR [Data]
Transmit Frequency [T1] [Data]
Unavailable Seconds [T1] [Data]

Refer to Appendix A for a definition of the Log and Results choices.

Triggers: — lists the transition events selected from the Available column that will generate a log output when that event occurs.

Add All >> — adds all transition events listed in the Available window to the transition events in the Show window.

Add > — adds the highlighted transition event(s) in the Available window to the column in the Show window. More than one event can be highlighted, allowing you to add a group of results at one time.

< Remove — removes the highlighted transition event(s) in the Triggers window and returns it to the column in the Available window. More than one event can be highlighted, allowing you to remove a group of results at one time.

<< Remove All — removes all the transition events listed in the Triggers window and returns them to the column in the Available window.

OK — when the Log Transition Setup window is properly configured, returns you to the Log Manager Setup window.

Cancel — ignores any changes made to the Log Transition Setup window since it was opened and returns you to the Log Manager window.

Help — displays context-sensitive information for the Log Transition Setup window.

Trigger Conditions For — allows you to select the trigger condition for the selected transition event. The trigger is selected by clicking on the desired event from those listed in the Triggers column. Clicking on an event in the Triggers column displays it so you can select a condition for it, if conditions apply for the selection you made. The following list of trigger conditions may or may not be available, depending on the Trigger selection:

Less than	Generates a log when the trigger is less than the specified value.
Less than or equal to	Generates a log when the trigger is less than or equal to the specified value.
Equal to	Generates a log when the trigger is equal to the specified value.
Greater than or equal to	Generates a log when the trigger is greater than or equal to the specified value.
Greater than	Generates a log when the trigger is greater than the specified value.
On	Generates a log when the state is on.
Off	Generates a log when the state is off.
Changes	Generates a log when the specified state changes.

Along with the trigger condition, you can set a value. The following is a list of the results available and the range you can select for the associated result.

Selection:	Range:
% Available Seconds [T1] [Data]	0.00 to 100.00
% Degraded Minutes [T1] [Data]	0.00 to 100.00
% Error-Free Seconds [T1] [Data]	0.00 to 100.00
% Severely Errored Seconds [T1] [Data]	0.00 to 100.00
AIS Seconds [T1]	0 to 2147483647 (2^{31}-1)
AIS [T1] [Data]	ON, OFF, or Changes
Available Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)
B8ZS [T1]	ON, OFF, or Changes
Bipolar Violations [BPVs] [T1]	0 to 9.223372036 x 10^{18} (2^{63}-1)
Bipolar Violations Rate [T1]	0.000000 to 1.000000
Bit Error Rate - SES [T1] [Data]	0.000000 to 1.000000
Bit Error Rate [T1] [Data]	0.000000 to 1.000000
Bit Errors - SES [T1] [Data]	0 to 9.223372036 x 10^{18} (2^{63}-1)
Bit Errors [T1] [Data]	0 to 9.223372036 x 10^{18} (2^{63}-1)
Clock Loss [Data]	ON, OFF, or Changes

Selection:	Range:
Clock Losses [Data]	0 to 4294967295 (2^{31}-1)
Clock Present [Data]	ON, OFF, or Changes
CRC Error Rate [T1]	0.000000 to 1.000000
CRC Errors [T1]	0 to 9.223372036 x 10^{18} (2^{63}-1)
CS [Data]	ON, OFF, or Changes
CTS [Data]	ON, OFF, or Changes
Data Loss [Data]	ON, OFF, or Changes
Degraded Minutes [T1] [Data]	0 to 2147483647 (2^{31}-1)
DM [Data]	ON, OFF, or Changes
DSR [Data]	ON, OFF, or Changes
DTR [Data]	ON, OFF, or Changes
Elapsed Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)
Error-Free Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)
Errored Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)
Far >320 CRC Errored Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far 101 to 319 CRC Errored Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far 11 to 100 CRC Errored Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far 2 to 5 CRC Errored Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far 6 to 10 CRC Errored Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far BPV Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far Controlled Slip Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far Errored Events [T1]	0 to 2147483647 (2^{31}-1)
Far Single Errored Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far Frame Errored Event Seconds [T1]	0 to 2147483647 (2^{31}-1)
Far Severely Frame Errored Seconds [T1]	0 to 2147483647 (2^{31}-1)
Frame Error Rate [T1]	0.000000 to 1.000000
Frame Errors [T1]	0 to 9.223372036 x 10^{18} (2^{63}-1)
Frame Loss [T1]	ON, OFF, or Changes
Frame Sync Loss Seconds [T1]	0 to 2147483647 (2^{31}-1)
Frame Sync Losses [T1]	0 to 2147483647 (2^{31}-1)
Frame Sync [T1]	ON, OFF, or Changes
G.821 Test Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)
LL [Data]	ON, OFF, or Changes
No Gen Clock [T1] [Data]	ON, OFF, or Changes
Pattern Loss [T1] [Data]	ON, OFF, or Changes
Pattern Slip [T1] [Data]	ON, OFF, or Changes
Pattern Slips [T1] [Data]	0 to 1.9.223372036 x 10^{19} (2^{63}-1)
Pattern Sync [T1] [Data]	ON, OFF, or Changes
Pattern Sync Loss Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)
Pattern Sync Losses [T1] [Data]	0 to 2147483647 (2^{31}-1)
Performance Report Time [T1]	0 to 2147483647 (2^{31}-1)
RAI (Yellow) [T1]	ON, OFF, or Changes
RAI Seconds (Yellow Alarm) [T1]	0 to 2147483647 (2^{31}-1)

Selection:	Range:
Receive Frequency [Data]	0.000 to 1.7 x 10^{15}
Receive Frequency [T1]	0 to 9.223372036 x 10^{18} (2^{63}-1)
RL [Data]	ON, OFF, or Changes
RLSD [Data]	ON, OFF, or Changes
RR [Data]	ON, OFF, or Changes
RS [Data]	ON, OFF, or Changes
RTS [Data]	ON, OFF, or Changes
Severely Errored Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)
Signal Loss Seconds [T1]	0 to 2147483647 (2^{31}-1)
Signal Losses [T1]	0 to 2147483647 (2^{31}-1)
Signal Loss [T1]	ON, OFF, or Changes
Signal [T1] [Data]	ON, OFF, or Changes
TM [Data]	ON, OFF, or Changes
TR [Data]	ON, OFF, or Changes
Transmit Frequency [T1] [Data]	0.000 to 1.7 x 10^{15}
Unavailable Seconds [T1] [Data]	0 to 2147483647 (2^{31}-1)

Refer to Appendix A for a definition of the Log and Results choices.

Log Once Only — generates only one log when the selected condition occurs. This causes only the first occurrence of a condition to generate a log and prevents the repeated logging of the same event.

Results Logged Per Log Trigger Event — result choices allow you to control log events. Results selected are logged to the selected output destination. Results available are interface-specific. Therefore, the interface selected determines the results that are available. Result choices include:

Standard — selects only a subset of all available results. Standard results available are determined by the operating configuration.

All — selects all the results.

Custom — allows you to select only results of interest to you.

Customize Output... — clicking on this box displays the Log Result Setup window (see Figure 12-5), which allows you to select the results that you want to log to the selected destination.

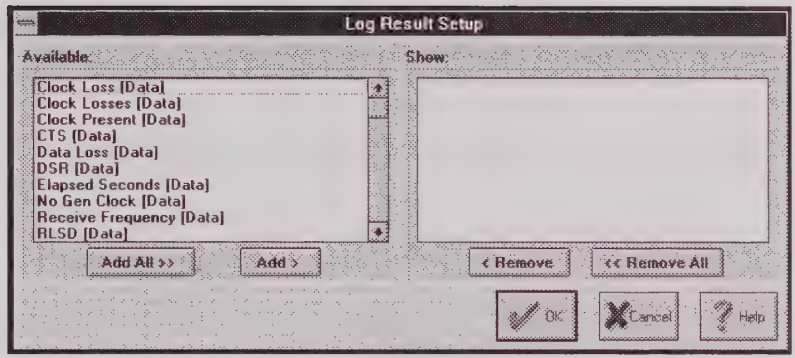

Figure 12-5
Log Result Setup Window

Available: — lists the available results that can generate a log output. Available result choices are determined by the selections on the T1 Configuration and Data Configuration windows. The following is a list of results that may be available and selected.

% Available Seconds [T1] [Data]
% Degraded Minutes [T1] [Data]
% Error-Free Seconds [T1] [Data]
% Severely Errored Seconds [T1] [Data]
AIS Seconds [T1]
Available Seconds [T1] [Data]
Bipolar Violations [BPVs] [T1]
Bipolar Violations Rate [T1]
Bit Error Rate - SES [T1] [Data]
Bit Error Rate [T1] [Data]
Bit Errors - SES [T1] [Data]
Bit Errors [T1] [Data]
CRC Error Rate [T1]
CRC Errors [T1]
Degraded Minutes [T1] [Data]
Elapsed Seconds [T1] [Data]
Error-Free Seconds [T1] [Data]
Errored Seconds [T1] [Data]
Far 2 to 5 CRC Errored Seconds [T1]
Far 6 to 10 CRC Errored Seconds [T1]
Far 11 to 100 CRC Errored Seconds [T1]
Far 101 to 319 CRC Errored Seconds [T1]
Far >320 CRC Errored Seconds [T1]
Far BPV Seconds [T1]
Far Controlled Slip Seconds [T1]
Far Errored Events [T1]
Far Single Errored Seconds [T1]
Far Frame Errored Event Seconds [T1]
Far Severely Frame Errored Seconds [T1]
Frame Error Rate [T1]
Frame Errors [T1]
Frame Sync Loss Seconds [T1]
Frame Sync Losses [T1]
G.821 Test Seconds [T1] [Data]
Pattern Slips [T1] [Data]
Pattern Sync Loss Seconds [T1] [Data]
Pattern Sync Losses [T1] [Data]
Payload Source & Loop Status [T1]
Performance Report Time [T1]
RAI Seconds (Yellow Alarm) [T1]
Receive Frequency [T1] [Data]
Round Trip Delay [T1] [Data]
Self Loop [T1] [Data]
Severely Errored Seconds [T1] [Data]
Signal Loss Seconds [T1]
Signal Losses [T1]
Transmit Frequency [T1] [Data]
Unavailable Seconds [T1] [Data]

Refer to Appendix A for a definition of the Log and Results choices.

Show: — lists the results that are selected for display in the results column.

Add All >> — adds all transition events listed in the Available window to the result events in the Show window.

Add > — adds the highlighted result event(s) in the Available window to the column in the Show window. More than one event can be highlighted, allowing you to add a group of results at one time.

< Remove — removes the highlighted result event(s) in the Show window and returns it to the column in the Available window. More than one event can be highlighted, allowing you to remove a group of results at one time.

<< Remove All — removes the result events listed in the Show window and returns them to the column in the Available window.

Result events can be selected in the following ways.

- Double-click on a result.
- Click on several result events, then click on **Add>**.
- Click on **Add All>>**.

The reverse is also true for removing result events from the Show column. Result events can be removed one at a time, several at a time, by groups, or all at once.

OK — confirms that the Log Result Setup window is properly configured and returns you to the Log Manager window.

Cancel — ignores any changes made to the Log Result Setup window since it was opened and returns you to the Log Manager window.

12.3 RESULTS

Selections made for the **Results** menu item determine what and how results are displayed.

Clicking on **Results**, on the T1/Data menu bar, displays a drop-down menu with the following menu items:

Customize Results...
Result Font...
Gridline Color...

Click on the desired menu item to display the associated window. The following sections describe the menu choices available for the **Results** menu.

Customize Results... Displays the Result Setup window (see Figure 12-6). With the Result Setup window displayed, you can determine how the results are displayed (in groups or alphabetically).

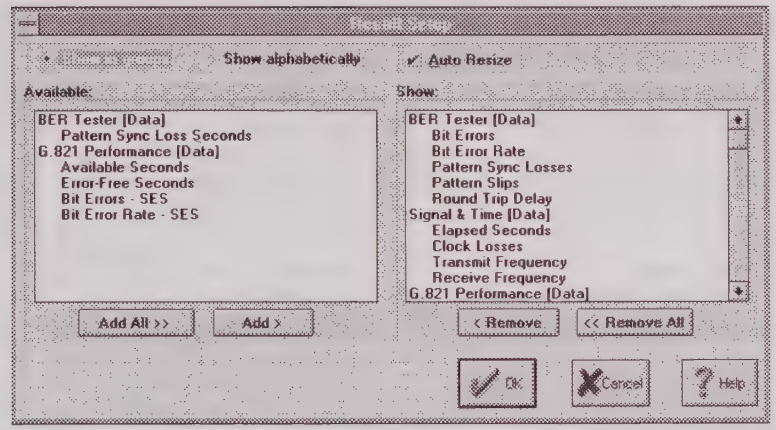

Figure 12-6
Result Setup Window

Show in groups — displays results in groups. The following list is an example of the available groups when T1 BERT is being performed:

Frame
BER Tester
Signal & Time
G.821 Performance
Configuration

Show alphabetically — displays results alphabetically.

Auto Resize — allows the Result display to be resized automatically to display all results selected.

Available: — lists the results that can be displayed on the result display. Click on a result displayed in the **Available:** listing to highlight it (can use **Shift**-click to highlight several results at once), then click on **Add >** to add the highlighted result(s) to the **Show:** listing. You can also double-click on a result in the **Available:** listing to add it to the **Show:** listing. Once an available result has been added, it is removed from the Available list and inserted in the Show list. Use the keys on the scroll bar to move through all the items in the Available list. The items listed are determined by the current configuration. Available choices include:

% Available Seconds [T1] [Data]
% Degraded Minutes [T1] [Data]
% Error-Free Seconds [T1] [Data]
% Severely Errored Seconds [T1] [Data]
AIS Seconds [T1]
AIS [T1] [Data]
Available Seconds [T1] [Data]
B8ZS [T1]
Bipolar Violations [BPVs] [T1]
Bipolar Violations Rate [T1]
Bit Error Rate - SES [T1] [Data]
Bit Error Rate [T1] [Data]
Bit Errors - SES [T1] [Data]
Bit Errors [T1] [Data]
Clock Loss [Data]
Clock Losses [Data]
Clock Present [Data]
CRC Error Rate [T1]
CRC Errors [T1]
CS [Data]
CTS [Data]
Data Loss [Data]
Degraded Minutes [T1] [Data]
DM [Data]
DSR [Data]
DTR [Data]
Elapsed Seconds [T1] [Data]
Error-Free Seconds [T1] [Data]
Errored Seconds [T1] [Data]
Far 2 to 5 CRC Errored Seconds [T1]
Far 6 to 10 CRC Errored Seconds [T1]
Far 11 to 100 CRC Errored Seconds [T1]
Far 101 to 319 CRC Errored Seconds [T1]
Far >320 CRC Errored Seconds [T1]
Far BPV Seconds [T1]
Far Controlled Slip Seconds [T1]
Far Errored Events [T1]
Far Single Errored Seconds [T1]
Far Frame Errored Event Seconds [T1]
Far Severely Frame Errored Seconds [T1]
Frame Error Rate [T1]
Frame Errors [T1]
Frame Loss [T1]
Frame Sync Loss Seconds [T1]
Frame Sync Losses [T1]
Frame Sync [T1]
G.821 Test Seconds [T1] [Data]
LL [Data]
No Gen Clock [T1] [Data]
Pattern Loss [T1] [Data]
Pattern Slip [T1] [Data]
Pattern Slips [T1] [Data]
Pattern Sync [T1] [Data]
Pattern Sync Loss Seconds [T1] [Data]
Pattern Sync Losses [T1] [Data]
Payload Source & Loop Status [T1]
Performance Report Time [T1]
RAI (Yellow) [T1]
RAI Seconds (Yellow Alarm) [T1]
Receive Frequency [T1] [Data]
RL [Data]
RLSD [Data]
Round Trip Delay [T1] [Data]
RR [Data]
RS [Data]
RTS [Data]
Self Loop [T1] [Data]
Severely Errored Seconds [T1] [Data]
Signal Loss Seconds [T1]
Signal Losses [T1]
Signal Loss [T1]
Signal [T1] [Data]
TM [Data]
TR [Data]
Transmit Frequency [T1] [Data]

Unavailable Seconds [T1] [Data]

Show: — lists the results that have been selected for display. Once an available result has been added, it is removed from the Available listing and inserted in the Show listing. Use the keys on the scroll bar to move through all the items in the Show column. The items listed are determined by the current configuration. Use the **<Remove** key to move a Show result to the Available column, or use the **<<Remove All** key to remove all remaining available results from the Show column.

Add All >> — adds all results listed in the Available window to the results in the Show window.

Add > — adds the highlighted results in the Available window to the column in the Show window. More than one result can be highlighted, allowing you to add a group of results at one time.

< Remove — removes the highlighted result in the Show window and returns it to the column in the Available window. More than one result can be highlighted, allowing you to remove a group of results at one time.

<< Remove All — removes all the results listed in the Show window and returns them to the column in the Available window.

OK — when the Result Setup window is properly configured, displays the selected result(s) in the Results window.

Cancel — ignores any changes made to the Result Setup window since it was opened and redisplays the configuration window.

Help — displays context-sensitive information for the Result Setup window.

Results can be selected in the following ways.

- Double-click on a result.
- Click on several result events, then click on **Add>**.
- Click on Add **All>>**.

The reverse is also true for removing results from the Show column. Results can be removed one at a time, several at a time, by groups, or all at once.

The following list of results indicates the condition that must be met before the result is considered to be a ready result.

Result:	Condition Required for Result to be Ready:
Data	
Bit Errors	Pattern Sync
BER	Pattern Sync
Pattern Sync	Always Ready
Pattern Loss History	Always Ready
Pattern Losses	Pattern Sync
Pattern Loss Seconds	Pattern Sync
Pattern Slips	Pattern Sync
Pattern Slip History	Pattern Sync
Pattern Delay	Measurement Complete
Elapsed Seconds	Always Ready
G.821 Seconds	Pattern Sync
Errored Seconds	Pattern Sync
Severely Errored Seconds	Pattern Sync
% Severely Errored Seconds	Pattern Sync
Error Free Seconds	Pattern Sync
% Error Free Seconds	Pattern Sync
Available Seconds	Pattern Sync
% Available Seconds	Pattern Sync
Unavailable Seconds	Pattern Sync
Non-Severely Errored Seconds BER	Pattern Sync
Non-Severely Errored Seconds Errors	Pattern Sync
Degraded Minutes	Pattern Sync
% Degraded Minutes	Pattern Sync
Self Loop	Always Ready
No Generator Clock	Always Ready
Transmit Frequency	Measurement Complete
Data Loss History	Always Ready
DTE Receiver Clock	Always Ready
DTE Receiver Clock Loss History	Always Ready
DTE Receiver Clock Losses	DTE Receiver Clock Present
DTE Receive Frequency	Measurement Complete
DTE LL	Always Ready
DTE RL	Always Ready
DTE RTS RS	Always Ready
DTE DTR TR	Always Ready
DCE Receiver Clock Loss History	Always Ready
DCE Receiver Clock Losses	DCE Receiver Clock Present
DCE Receive Frequency	Measurement Complete
DCE RI	Always Ready
DCE RLSD RR	Always Ready
DCE CTS CS	Always Ready
DCE DSR DM	Always Ready

T1

Result:	Condition Required for Result to be Ready:
Frame Sync	Always Ready
Frame Loss History	Always Ready
Frame Losses	Frame Sync
Frame Loss Seconds	Frame Sync
Signal Present	Always Ready
Signal Loss History	Always Ready
Signal Losses	Signal Present
Signal Loss Seconds	Signal Present
B8ZS	Signal Present
AIS	Signal Present
AIS Seconds	Signal Present
RAI	Frame Sync
RAI Seconds	Frame Sync
No Generator Clock	Always Ready
Receive Frequency	Measurement Complete
Transmit Frequency	Measurement Complete
BPVs	Signal Present
BPV Rate	Signal Present
Frame Errors	Frame Sync
Frame Error Rate	Frame Sync
CRC Errors	Frame Sync
CEC Error Rate	Frame Sync
Payload Source & Loop Status	Reception of EFS Performance Report Message
Performance Report Time	Reception of EFS Performance Report Message
Far CRC Single Errored Seconds	Reception of EFS Performance Report Message
Far 2 to 5 CRC Errored Seconds	Reception of EFS Performance Report Message
Far 6 to 10 CRC Errored Seconds	Reception of EFS Performance Report Message
Far 11 to 100 CRC Errored Seconds	Reception of EFS Performance Report Message
Far 101 to 319 CRC Errored Seconds	Reception of EFS Performance Report Message
Far >320 CRC Errored Seconds	Reception of EFS Performance Report Message
Far Errored Events	Reception of EFS Performance Report Message
Far Severely Errored Frame Seconds	Reception of EFS Performance Report Message

Result:	Condition Required for Result to be Ready:
Frame Errors	Reception of EFS Performance Report Message
Far BPV Seconds	Reception of EFS Performance Report Message
Far Controlled Slip Seconds	Reception of EFS Performance Report Message

Result Font...

Displays the Font window (see Figure 12-7), which allows you to choose the Font, Font Style, Size, and Color for the displayed results text. The Sample area is provided to give you an indication of how the selection would appear. Information is included below the Sample area providing you with information about the selected font.

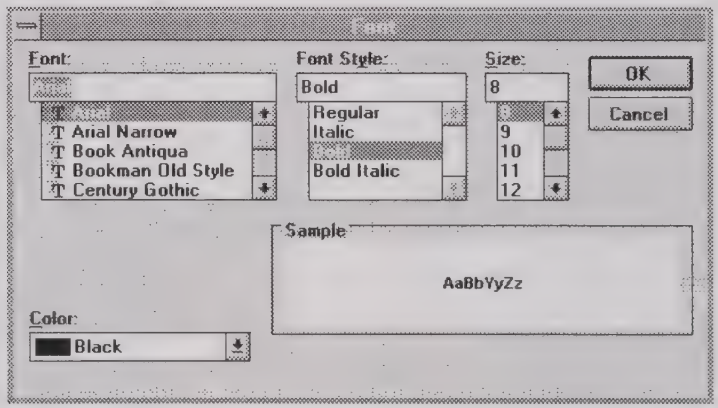

Figure 12-7
Result Font Window

Gridline Color...

Displays the Color window (see Figure 12-8), which allows you to select basic colors and custom colors for lines and borders for the results display.

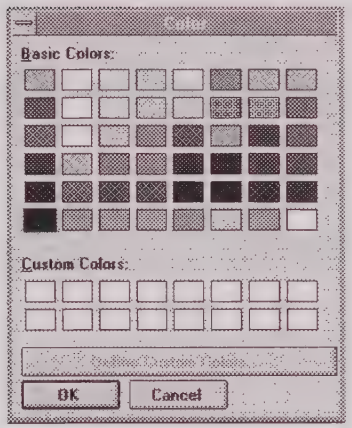

Figure 12-8
Color Window

SECTION 13
APPLICATIONS

13.1 SECTION OVERVIEW

This section describes some test scenarios for a FIREBERD 300/500 that is equipped with a T1/Data Test Module. These test scenarios are presented only in general terms, since the specific testing environment may vary significantly.

NOTE: If you have installed the T1/Data test module or have reconfigured the mainframe, you may have to perform the EISA configuration utility. Refer to Section 1 for the step-by-step instructions for running the EISA configuration utility.

The following test type scenarios are described in this section.

Data BERT - emulate DTE and emulate DCE
T1 BERT - receive only (monitor), loopback, and round-trip delay measurement
FT1 -
DDS (SW56) - only for FIREBERD 500
DDS (DS0A/B)

13.2 DATA BERT

Selecting **Data BERT** as the **Test Type**, you can test data circuits. When testing data circuits, you are performing an intrusive test. The following procedure indicates the steps to take to perform a BERT while emulating a DTE and DCE device.

13.2.1 Emulate a DTE Device

1. Connect the FIREBERD 300/500 mainframe to the circuit you want to test. Attach a cable from the 25-pin RS-232 connector on the T1/Data Test Module to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **Data BERT**.

5. Configure the Data Configuration window as follows:

Interface:	RS-232
Access Type:	Emulate DTE
Pattern:	2047
DTE:	RTS and DTR (check mark next to each label)
Generator Clock:	Internal (Synthesizer)

6. Observe the LED indication on the Data Status window and observe the RESULTS STATUS and ALARM LEDs on the DKA.

7. Click on **Results** on the T1/Data window and select **Customize Results...** to observe the results selected for the test you will conduct. Select the results you want to be displayed in the Results window.

8. Click on **Test Restart** and observe the accumulated results in the results window.

13.2.2 Emulate a DCE Device

1. Connect the FIREBERD 300/500 mainframe to the circuit you want to test. Attach a cable from the 25-pin RS-232 connector on the T1/Data test module to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **Data BERT**.

5. Configure the Data Configuration window as follows:

Interface:	RS-232
Access Type:	Emulate DCE
Pattern:	2047
DCE:	RLSD, DSR, and CTS (check mark next to each label)
Generator Clock:	Internal (Synthesizer)

6. Observe the LED indication on the Data Status window and observe the RESULTS STATUS and ALARM LEDs on the DKA.

7. Click on **Results** on the T1/Data window and select **Customize Results...** to observe the results selected for the test you will conduct. Select the results you want to be displayed in the Results window.

8. Click on **Test Restart** and observe the accumulated results in the results window.

13.3 T1 BERT

13.3.1 Physical Layer Monitoring

1. Connect the FIREBERD 300/500 mainframe to the circuit you want to test. Attach a cable from the bantam connector on the T1/Data Test Module to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **T1 BERT**.

5. Configure the T1 Configuration - Top Level window as follows:

Test Mode:	Full T1
Access:	Receive Only
Analysis Port(s):	Line 1
Framing:	for the T1 format
Input:	DSX Monitor

6. Observe the LED indication on the T1 Status window and observe the RESULTS STATUS and ALARM LEDs on the DKA. Click on **Reset History** to clear any red history LEDs that are illuminated.

7. Observe the T1 Status display. When the Frame Sync and Signal LEDs are green, synchronization has been achieved.

8. Click on **Results** on the T1/Data window highlight **Customize Results...** to observe the results selected for the test you will conduct. Select the results you want to be displayed in the Results window.

9. Click on **Test Restart** and observe the accumulated results in the results window.

13.3.2 Loopback Test

1. Connect the FIREBERD 300/500 mainframe to the circuit you want to test. Attach a cable from the bantam connector, on the T1/Data Test Module, to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **T1 BERT**.

5. Configure the T1 Configuration - Top Level window as follows:

Test Mode:	Full T1
Access:	Originate
Analysis Port(s):	Line 1
Framing:	for the T1 format
Pattern:	select the pattern that you are going to transmit
Input:	Terminating
Line Build Out:	0 dB
Generator Clock Source	Recovered

6. Observe the LED indication on the T1 Status window and observe the RESULTS STATUS and ALARM LEDs on the DKA. Click on **Reset History** to clear any red history LEDs that are illuminated.

7. Click on **Loopback...** to display the T1 Loopback Configuration window.

8. Configure the T1 Loopback Configuration window as follows:

Loop Code:	CSU

9. Click on **Loop Up** to begin transmitting the CSU loop up code (10000) and display a window indicating that the loop code is being transmitted.

10. Observe the T1 Status display. When the following green LEDs are illuminated, CSU loopback has been achieved.

    Pattern Sync
    Frame Sync
    Signal

11. Click on **Results** on the T1/Data window and highlight **Customize Results...** to observe the results selected for the test you will conduct. Select the results you want to be displayed in the Results window.

12. Click on **Test Restart** and observe the accumulated results in the results window.

13.3.3 Round-trip Delay Measurement

1. Connect the FIREBERD 300/500 mainframe to the circuit you want to test. Attach a cable from the bantam connector, on the T1/Data Test Module, to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **T1 BERT**.

5. Configure the T1 Configuration - Top Level window as follows:

Test Mode:	Full T1
Access:	Originate
Analysis Port(s):	Line 1
Framing:	for the T1 format
Pattern:	2^15-1
Input:	Terminating
Line Build Out:	0 dB
Generator Clock Source	Recovered
Self Loop	Check mark in box

6. Observe and record the displayed Round Trip Delay value.

7. Observe the LED indication on the T1 Status window and observe the RESULTS STATUS and ALARM LEDs on the DKA. Click on **Reset History** to clear any red history LEDs that are illuminated.

8. Click on **Loopback...** to display the T1 Loopback Configuration window.

9. Configure the T1 Loopback Configuration window as follows:

Loop Code:	CSU

10. Click on **Loop Up** to begin transmitting the CSU loop up code (10000) and display a window indicating that the loop code is being transmitted.

11. Observe the T1 Status display. When the following green LEDs are illuminated, synchronization has been achieved.

    Pattern Sync
    Frame Sync
    Signal

12. Click on **Results** on the T1/Data window and highlight **Customize Results...** to verify the round trip delay result appears in the Show: column. If it doesn't, click on it and add it to the Show: column.

13. Click on Test Restart and observe the Round Trip Delay value displayed in the results window.

14. Subtract the Round Trip Delay value recorded previously from the currently displayed Round Trip Delay value to obtain an accurate round trip delay value.

13.3.4 Fractional T1

1. Connect the FIREBERD 300/500 mainframe to the circuit you want to test. Attach a cable from the bantam connector, on the T1/Data Test Module, to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **T1 BERT**.

5. Configure the T1 Configuration - Top Level window as follows:

Test Mode:	Fractional T1
Access:	Originate
Analysis Port(s):	Line 1
Framing:	for the T1 format
Pattern:	2047
Input:	Terminating
Line Build Out:	0 dB
Generator Clock Source	Recovered

6. Click on **Fractional T1...** to display the Fractional T1 Configuration -Originate window.

7. Configure the Fractional T1 Configuration - Originate window as follows:

Rate:	64 kbps
Tx/Rx	Click to place check marks in the following boxes: 1, 2, 3, 4, and 5

8. Observe that the Total Transmit Rate and Total Receive Rate are 320 kbps.

9. Click on **T1 Top Level** to redisplay the Fractional T1 Configuration-Originate window.

10. Observe the T1 Status display. When the following green LEDs are illuminated, synchronization has been achieved.

    Pattern Sync
    Frame Sync
    Signal

11. Click on **Results** on the T1/Data window and highlight **Customize Results...** to observe the results selected for the test you will conduct on the selected channels. Select the results you want to be displayed in the Results window.

12. Click on **Test Restart** and observe the accumulated results in the results window.

13.3.5 DDS (SW56)

1. Connect the FIREBERD 500 mainframe to the circuit you want to test. Attach a cable from the bantam connector, on the T1/Data Test Module, to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **T1 BERT**.

5. Configure the T1 Configuration - Top Level window as follows:

Test Mode:	DDS (SW 56)
Access:	Originate
Analysis Port(s):	Line 1
Framing:	for the T1 format
Pattern:	2047
Input:	Terminating
Line Build Out:	0 dB

6. Click on **DDS (SW56)...** to display the T1 Switched 56 (DDS) - (Emulation) - Originate window and configure it as follows:

DS1 Channel	1
Supervision:	Originate
Event:	As required to establish the connection

The following connection sequence is an example of originating a call.

Connection Sequence:	
1	**Receive Terminating on Hook**
2	**Transmit Originating Off Hook**
3	**Receive Terminating Wink**
4	**DP: 3531560**
11	**Receive Terminating Off Hook**

7. Click on **Start** to begin the connection sequence and display the SW 56 Events window to observe the origination sequence of events.

8. When the connection is successfully established, click on **T1 Top Level** to redisplay the T1 Configuration - Top Level window.

9. Observe the LED indication on the T1 Status window. Click on **Reset History** to clear any red history LEDs that are illuminated.

10. Observe the T1 Status display. When the following green LEDs are illuminated, synchronization has been achieved.

    Pattern Sync
    Frame Sync
    Signal

11. Click on **Results** on the T1/Data window and highlight **Customize Results...** to observe the results selected for the test you will conduct. Select the results you want to be displayed in the Results window.

12. Click on **Test Restart** and observe the accumulated results in the results window.

13.3.6 DDS (DS0A/B)

1. Connect the FIREBERD 300/500 mainframe to the circuit you want to test. Attach a cable from the bantam connector, on the T1/Data Test Module, to the circuit you want to test.

2. Turn the FIREBERD 300/500 power on and verify the Test Manager window is displayed.

3. In the Test Manager window, click on the T1/Data icon to display the T1/Data configuration window.

4. Set the **Test Type** to **T1 BERT**.

5. Configure the T1 Configuration - Top Level window as follows:

Test Mode:	DDS (DS0A/B)
Access:	Originate
Analysis Port(s):	Line 1
Framing:	for the T1 format
Pattern:	N/A
Input:	Terminating
Line Build Out:	0 dB
Generator Clock Source	Recovered

6. Click on **DDS (DS0A/B)...** to display the DS0A/B Analysis - Originate window, and configure it as follows:

DS1 Channel:	1
Channel Format:	DS0A
Analysis Channel:	Primary
Strip Network Control Information	No check mark
Data Rate:	9.6k
DS0B Channel	N/A

7. Click on **T1 Top Level** to redisplay the T1 Configuration - Top Level window.

8. Observe the LED indication on the T1 Status window and observe the RESULTS STATUS and ALARM LEDs on the DKA. Click on **Reset History** to clear any red history LEDs that are illuminated.

9. Observe the T1 Status display. When the following green LEDs are illuminated, synchronization has been achieved.

   Pattern Sync
   Frame Sync
   Signal

10. Click on **Results**, on the T1/Data window, highlight **Customize Results...** to observe the results selected for the subrate test you will conduct. Select the results you want to be displayed in the Results window.

11. Click on **Test Restart** and observe the accumulated results in the results window.

SECTION 14
SPECIFICATIONS

14.1 SECTION OVERVIEW

This section describes the T1/Data physical connectors, the pin designations, and electrical characteristics for each.

14.2 RS-232

This 25-pin, D-type, female connector provides the physical interface for connection to data circuits using the RS-232-D connector. Table 14-1 lists the RS-232-D connector pinouts for use with RS-232-D circuits.

Table 14-1
RS-232-D Connector Pinouts

Pin:	Designation:	Description:	DTE Mode:	DCE Mode:	MON Mode:
1	Shield	Shield	Shield	Shield	Shield
2	TD	Transmit Data	TX	RX	RX
3	RD	Receive Data	RX	TX	RX
4	RTS	Request To Send	TX	RX	RX
5	CTS	Clear To Send	RX	TX	RX
6	DSR	Data Set Ready	RX	TX	RX
7	SG	Signal Ground	Gnd	Gnd	Gnd
8	RLSD	Received Line Signal Detect	RX	TX	RX
15	TC	Transmit Clock (DCE Source)	RX	TX	RX
17	RC	Receive Clock (DCE Source)	RX	TX	RX
18	LL	Local Loopback	TX	RX	RX
20	DTR	Data Terminal Ready	TX	RX	RX
21	RL	Remote Loopback	TX	RX	RX
24	XTC	Transmit Clock (DTE Source)	TX	RX	RX
25	TM	Test Mode	RX	TX	RX

14.3 RS-449

This 50-pin, D-type, female connector provides the physical interface for connection to data circuits using the 50-pin connector. Table 14-2 lists the 50-pin connector pinouts for use with RS-449 circuits.

Table 14-2
50-Pin Connector Pinouts for RS-449 Operation

Pin:	Designation:	Description:	DTE Mode:	DCE Mode:	MON Mode:
1	Shield	Shield	Shield	Shield	Shield
12	SG	Signal Ground	Gnd	Gnd	Gnd
13	SD	Send Data A	TX	RX	RX
14	SD	Send Data B	TX	RX	RX
15	RD	Receive Data A	RX	TX	RX
16	RD	Receive Data B	RX	TX	RX
17	RT	Receive Timing (DCE Source) A	RX	TX	RX
18	RT	Receive Timing (DCE Source) B	RX	TX	RX
19	ST	Send Timing (DCE Source) A	RX	TX	RX
20	ST	Send Timing (DCE Source) B	RX	TX	RX
21	TT	Terminal Timing (DTE Source) A	RX	TX	RX
22	TT	Terminal Timing (DTE Source) B	RX	TX	RX
23	RR	Receiver Ready (RLSD) A	RX	TX	RX
24	RR	Receiver Ready (RLSD) B	RX	TX	RX
25	TM	Test Mode	RX	TX	RX
36	TR	Terminal Ready A	TX	RX	RX
38	TR	Terminal Ready B	TX	RX	RX
40	RS	Request To Send A	TX	RX	RX
42	RS	Request To Send B	TX	RX	RX
43	SC	Send Common	Gnd	Gnd	Gnd
44	CS	Clear To Send A	RX	TX	RX
45	RC	Receive Common	Gnd	Gnd	Gnd
46	CS	Clear To Send B	RX	TX	RX
47	RL	Remote Loopback A	TX	RX	RX
48	DM	Data Mode A	RX	TX	RX
49	LL	Local Loopback A	TX	RX	RX
50	DM	Data Mode B	RX	TX	RX

14.4 V.35 FOR BALANCED CIRCUITS

This 50-pin, D-type, female connector provides the physical interface for connection to data circuits using the 50-pin connector. Table 14-3 lists the 50-pin connector pinouts for use with balanced V.35 circuits.

Table 14-3
50-Pin Connector Pinouts for V.35 Operation for Balanced Circuits

Pin:	Std:	Designation:	Description:	DTE Mode:	DCE Mode:	MON Mode:
1	A	Shield	Shield	Shield	Shield	Shield
2	P	SD	Transmit Data A	TX	RX	RX
3	S	SD	Transmit Data B	TX	RX	RX
4	U	SCTE	Serial Clock Transmit External A	TX	RX	RX
5	W	SCTE	Serial Clock Transmit External B	TX	RX	RX
6	R	RD	Receive Data A	RX	TX	RX
7	T	RD	Receive Data B	RX	TX	RX
8	V	SCR	Serial Clock Receive A	RX	TX	RX
9	X	SCR	Serial Clock Receive B	RX	TX	RX
10	Y	SCT	Serial Clock Transmit (DCE) A	RX	TX	RX
11	AA	SCT	Serial Clock Transmit (DCE) B	RX	TX	RX
12	B	SG	Signal Ground	Gnd	Gnd	Gnd

14.5 V.35 FOR UNBALANCED CIRCUITS

This 50-pin, D-type, female connector provides the physical interface for connection to data circuits using the 50-pin connector. Table 14-4 lists the 50-pin connector pinouts for use with unbalanced V.35 circuits.

Table 14-4
50-Pin Connector Pinouts for V.35 Operation for Unbalanced Circuits

Pin:	Std:	Designation:	Description:	DTE Mode:	DCE Mode:	MON Mode:
1	A	Shield	Shield	Shield	Shield	Shield
12	B	SG	Signal Ground	Gnd	Gnd	Gnd
26	C	RS	Request To Send	TX	RX	RX
28	D	CS	Clear To Send	RX	TX	RX
27	NN	TM	Test Mode	RX	TX	RX
29	N	RL	Remote Loopback	TX	RX	RX
30	E	DSR	Data Set Ready	RX	TX	RX
31	L	LL	Local Loopback	TX	RX	RX
32	F	RLSD	Received Line Signal Detect	RX	TX	RX
34	H	DTR	Data Terminal Ready	TX	RX	RX

14.6 SPECIFICATIONS

14.6.1 RS-232-D Specifications

General

Data rate, low speed signaling: 50 b/s to 20 kb/s
Data rate, high speed data/clocks: 50 b/s to 115 kb/s

Drivers

Slew Rate: <30 V/µs

Receivers

Load Impedance, R_L: 3 kΩ <R_L <7 kΩ
Input Voltage, max.: <±25 V

Polarity

Normal Data Polarity:
Mark (Binary 1): <-3.0 V (with respect to signal ground)
Space (Binary 0): >+3.0 V (with respect to signal ground)

Signal Polarity

ON:	>+3.0 V (with respect to signal ground)
OFF:	<-3.0 V (with respect to signal ground)

14.6.2 RS-449 Specifications

General

Data Rate:

422: 50 b/s to 2 Mb/s

423: 50 b/s to 120 kb/s

Output Voltage: ±3.5 V min. into 100Ω

Data Polarity:

Category 1 RS-422/V.11

Data Mark (Binary 1):	"A" lead more negative than "B" lead
Data Space (Binary 0):	"B" lead more negative than "A" lead
Control OFF (Binary 1):	"A" lead more negative than "B" lead
Control ON (Binary 0):	"B" lead more negative than "A" lead

Category 2 RS-423/V.10

Control OFF (Binary 1):	Negative polarity
Control ON (Binary 0):	Positive polarity

Receivers

Category 1 RS-422/V.11 Terminated

Load Impedance:	100Ω ±10%
Input Threshold Voltage:	±0.25 V

Category 1 RS-422/V.11 Unterminated

Load Impedance:	2 kΩ, min.
Input Threshold Voltage:	±0.25 V

Category 2 RS-423/V.10

Load Impedance:	2 kΩ, min.
Input Threshold Voltage:	±0.25 V

Generator

Timing Mode:	Synchronous
Synchronous Data Rate:	50 Hz to 2.0 MHz, min.
Timing Sources:	Synthesizer, Interface, or External (BNC)
Transmit Mode:	Continuous
Fixed Patterns:	All 1s, All 0s, 1:1, or Programmable

Pseudorandom Patterns:	2^{23}-1, 2^{23}-1 Reverse, 2^{20}-1, 2^{20}-1 Reverse, 2^{15}-1, QRSS, 2^{11} 1, 2^{9}-1, or 2^{6}-1
Programmable Patterns:	3 to 24 bit (can be 3 in 24, 2 in 8, 1 in 3, or 1 in 7)
Error Insertion:	Single or Rate
Error Insertion Rate:	1.0E-3

Receiver

Timing Mode:	Synchronous
Synchronous Data Rate:	50 Hz to 2.0 MHz, min.
Timing Sources:	Receive Data Interface
Analysis Mode:	Continuous
Data Polarity Control:	Normal or Inverted

14.6.3 V.35/306 Specifications

General

Data Rate:	
306 mode	50 b/s to 2 Mb/s
V.35 mode	cable length dependent

Balanced Drivers

Signal Swing (Bipolar):	±0.55 V ±0.1 V into 100Ω
Short Circuit Current:	< 100 mA.
Rise Time:	< 20 ns.
Output Impedance:	< 100Ω ±50%
Differential Output Impedance:	150Ω

Balanced Receivers

Input Impedance, terminated:	100Ω
Input Impedance, unterminated:	> 8 kΩ ±10%

Unbalanced Drivers (EIA-232D)

Slew Rate:	<30 V/µs
Output Impedance:	< 100Ω
Signal Swing:	> 10 V into 7 kΩ
Short Circuit Current:	< 100 mA.

Unbalanced Receivers

Load Impedance, RL:	3 kΩ <R_L <7 kΩ
Input Voltage, max.:	<±25 V

Polarity

Data Polarity:	
Mark (Binary 1)	"A" lead negative with respect to "B" lead
Space (Binary 0)	"B" lead positive with respect to "A" lead
Control Polarity	
On	> +3 V
Off	< -3 V

14.6.4 T1 Specifications

Receive Inputs

Input Frequency:	1.544 Mb/s, ±5 ppm
	Input Impedance: Terminating — 100Ω, ±5% DSX-Monitor — 100Ω, ±5% Bridge — 1 kΩ, minimum
Operating Range:	Terminating — +6 dBdsx to -35 dBdsx (cable attenuation) DSX-Monitor — +6 dBdsx to -35 dBdsx (cable attenuation) Bridge — -10 dBdsx to -24 dBdsx (resistive attenuation)

Transmit Outputs

Output Frequency:	1.544 Mb/s, ±5 ppm
Output Line Build Out:	0, -7.5, or -15 dBm at 722 kHz, all ±1 dB
Pulse Shape:	Meets Bell Pub CB113, CB119, CB143 and AT&T Pubs 41451, 62411, and 62508

APPENDIX A
RESULTS DEFINITIONS

A.1 SECTION OVERVIEW

This appendix contains a list of available results and their definitions.

% Available Seconds — the ratio, expressed as a percentage, of Available Time to Test Seconds.

% Degraded Minutes — the number of degraded minutes, expressed as a percentage of available time.

% Error Free Seconds — the ratio of Error Free Seconds to Available Seconds.

% Severely Errored Seconds — the ratio of severely errored seconds (the number of seconds with detected errors or a Bit Error Rate greater than 1 in 10^3) to available time.

AIS Seconds — Alarm Indication Signal (AIS) Seconds are the number of seconds since the beginning of a test, during which the AIS bit was active.

Available Seconds — every test is restarted in available seconds. Any time during which the 10 preceding consecutive seconds were not Severely Errored Seconds.

Bipolar Violations (BPVs) — the number of BPVs counted since signal presence was detected. Indicates that the same polarity was detected for adjacent bit values.

Bit Error Rate - SES — the bit error rate calculated over the test interval, excluding any bit errors detected during Severely Errored Seconds.

Bit Error Rate — the total number of bit errors counted over the last test interval, divided by the total number of data bits counted in the last test interval.

Bit Errors - SES — the number of bit errors that were detected, minus any bit errors detected during Severely Errored Seconds.

Bit Errors — the total number of errored data bits counted, since the beginning of the test or since initial pattern synchronization.

Clock Losses — the number of times a clock loss was counted.

CRC Errors — Cyclic Redundancy Check (CRC) Errors are counted when the checksum does not match the contents of the frame. CRC-6 is used to check 24 frames of data for T1 data.

Degraded Minutes — an error analysis result that is the number of minutes during which a bit error rate greater than 1 in 10^6 occurs.

Elapsed Seconds — the total number of seconds counted since the last test restart occurred.

Error-Free Seconds (EFS) — the number of seconds during which no bit errors are detected.

Errored Seconds — the number of seconds during which one or more bit errors are detected.

Far 2 to 5 CRC Errored Seconds — the number of seconds with 2 to 5 CRC errors reported in the received signal at the far end of a test. This result reports on the second Performance Report Message CRC Error Event bit.

Far 6 to 10 CRC Errored Seconds — the number of seconds with 6 to 10 CRC errors reported in the received signal at the far end of a test. This result reports on the third Performance Report Message CRC Error Event bit.

Far 11 to 100 CRC Errored Seconds — the number of seconds with 11 to 100 CRC errors reported in the received signal at the far end of a test. This result reports on the fourth Performance Report Message CRC Error Event bit.

Far 101 to 319 CRC Errored Seconds — the number of seconds with 101 to 319 CRC errors reported in the received signal at the far end of a test. This result reports on the fifth Performance Report Message CRC Error Event bit.

Far > 320 CRC Errored Seconds — the number of seconds more than 320 CRC errors reported in the received signal at the far end of a test. This result reports on the sixth Performance Report Message CRC Error Event bit.

Far BPV Seconds — the number of seconds in which 1 or more BPVs occur in the received signal at the far end. This result reports on the Performance Report Message Line Code Violation Event bit (LV = 1) status.

Far Controlled Slip Seconds — the number of seconds in which controlled slips occur in less than 3 milliseconds in the received signal at the far end. This result reports on the Performance Report Message Controlled Slip Event (LV = 1) status.

Far CRC Errored Events — the number of the minimum number of CRC errors reported in the Far End CRC bins. This result reports on the Performance Report Message CRC Error Event bit.

Far CRC Single Errored Seconds — the number of seconds with only 1 CRC error reported in the received signal at the far end of a test. This result reports on the first Performance Report Message CRC Error Event bit.

Far Frame Errored Event Seconds — the number of seconds in which 1 or more Frame Errors occur in the received signal at the far end.

Far Frame Severely Errored Seconds — the number of seconds in which 2 or more errors occur in the received signal at the far end. This result reports on the Performance Report Message Frame Synchronization Bit Error Event status.

Far Severely Errored Seconds — the number of seconds in which 2 or more Frame Errors occur within 3 milliseconds in the received signal at the far end.

Frame Errors — the total number of errored framing bits counted after frame synchronization occurs. A frame error is the measurement of the number of times the framing bit is in error.

Frame Sync Losses — the total number of seconds in which frame synchronization was lost.

G.821 Test Seconds — the total number of seconds in a test, as calculated in G.821.

Pattern Slips — the number of occurrences where extra or missing data bits are detected in a pseudorandom pattern. This result is only available when pseudorandom patterns are received.

Pattern Synchronization Loss Seconds — the total number of seconds during which a loss of pattern synchronization occurs. Pattern synchronization loss is declared when 250 bit errors are counted in less than 1000 bits received for synchronous timing.

Pattern Synchronization Losses — the number of synchronization losses since the last test restart. Pattern synchronization loss is declared when 250 bit errors are counted in less than 1000 bits received for synchronous timing.

Payload Source & Loop Status — identifies the direction of the Performance Report Message (PRM), according to the PRM Command /Response bit and the Payload Loopback Activated bit.

Performance Report Time — the number of seconds, since the test started, in which a valid PRM was received.

RAI Seconds (Yellow Alarm) — the Remote Alarm Indication (RAI) signal is a bit-oriented message on the ESF data link indicating that an out-of-frame condition occurred. It shows the number of seconds, since the beginning of the test in which a yellow alarm was active.

Receive Frequency — the current measured receiver clock frequency, measured in Hertz (Hz).

Round Trip Delay — the time delay measured between transmitting and receiving the same bit in a pseudorandom pattern, measured in microseconds. When a very accurate round trip delay measurement is required, perform a self loop test first, then subtract the self loop delay value from the round trip value measured for the circuit.

Self Loop — loops only the T1/Data module transmitter to its receiver and internally disconnects the module connectors.

Severely Errored Seconds (SES) — the number of available seconds with detected errors or a Bit Error Rate greater than 1 in 10^3. A signal loss second, or a second during which pattern synchronization is lost is also considered a SES.

Signal Loss Seconds — the number of test seconds during which signal loss was declared for any portion of that second.

Signal Losses — the number of times the receiver signal was no longer detected.

Transmit Frequency — the current measured transmitter clock frequency, measured in Hertz (Hz).

Unavailable Seconds — after 10 consecutive seconds of Severely Errored Seconds, (i.e., seconds having a BER greater than 1 in 10^3) the transition from Available Time to Unavailable Time occurs. Unavailable Time does not transition to Available Time until 10 consecutive seconds occur with a Bit Error Rate less than 1 in 10^3.

APPENDIX B
T1/DATA API

B.1 SECTION OVERVIEW

This appendix describes the Application Programming Interface (API) that is used by programmers to bypass the user interface and directly access accumulated T1/Data results. The API is a collection of library functions that can be linked into a Windows application written in MS Visual Basic or C language. API provides you with the tools to develop code as an alternative to using the standard user interface to retrieve results accumulated by the T1/Data test module.

The T1/Data API is distributed in the form of files having the following extensions:

.DLL
.LIB

B.2 OPERATION

In order for you to use API for the T1/Data test module, the T1/Data application must first be running. With the T1/Data application running, you then declare the API function. The way in which you declare a function is determined by the program that you are using.

After declaring the function, you would then issue the following string to obtain a result value:

```
DATT1_Get_Data (int Slot_Number, int card_type, int nth_of_card_type,
int Result_ID, double far *lpdbResult, LPSTR lpBuffer, int cbSize)
```

Where the integer values are as follows:

`int Slot_Number`	= 1 to 3	Indicates the mainframe slot in which T1/Data is installed.
`int card_type`	= 0	Indicates the card type (0=T1/Data).
`int nth_of_card_type`	= 0	Indicates the selected T1/Data card when more than 1 is installed.
`int Result_ID`	= 0 to 114	Indicates the result for which the value is returned.

The following list indicates the Result_ID number and the result associated with that number.

Bit Errors	0
BER	1
Pattern Sync	2
Pattern Loss History	3
Pattern Losses	4
Pattern Loss Seconds	5
Pattern Slips	6
Pattern Slip History	7
Pattern Delay	8
Elapsed Seconds	9
G.821 Seconds	10
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DTE Receive Frequency	30
DTE LL	31
DTE RL	32
DTE RTS RS	33
DTE DTR TR	34
DCE Receiver Clock	35
DCE Receiver Clock Loss History	36
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DCE Receive Frequency	38
DCE RI	39
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Line 2 CRC Errors	99
Line 2 CEC Error Rate	100
Line 2 Payload Source & Loop Status	101
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Line 2 Far 2 to 5 CRC Errored Seconds	104
Line 2 Far 6 to 10 CRC Errored Seconds	105
Line 2 Far 11 to 100 CRC Errored Seconds	106
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Line 2 Far Errored Events	109
Line 2 Far Severely Errored Frame Seconds	110
Line 2 Frame Errors	111
Line 2 Far BPV Seconds	112
Line 2 Far Controlled Slip Seconds	113
Result Total Summary	114

The following result interval values are returned for the associated condition.

Condition:	**Value Returned:**
Result OK	0
Invalid Result Request	-1
Busy (Reentrance)	-2
Result Not Ready	-3
Overflow	-4
Underflow	-5
Divided By 0	-6
Can't Find Interface	-7
Error	-8

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Telecommunications Techniques Corporation ®
20400 Observation Drive, Germantown, Maryland 20876
Tel. (800) 638-2049 • (301) 353-1550 • FAX (301) 353-9216
WWW Address: http://www.ttc.com